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PROPOSAL FOR
UNITED STATES AIR FORCE
AIR REFUELING OPERATIONS DOCTRINE

GRADUATE RESEARCH PAPER

Philip A. Iannuzzi, Jr., Major, USAF

AFIT/GMO/LAL/96N-3

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GRADUATE RESEARCH PAPER

Presented to the Faculty of the Graduate School of

Logistics and Acquisition Management of the

Air Force Institute of Technology

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In Partial Fulfillment of the

Requirements for the Degree of

Master of Air Mobility

Philip A. Iannuzzi, Jr., B.S., M.S.

Major, USAF

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Philip A. Iannuzzi, Jr.

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Abstract

The United States Air Force, the aerospace arm of the United States' armed forces, has developed basic aerospace doctrine to guide and direct operations in the aerospace medium. The basic objective of aerospace forces is to take decisive action against an adversary's vulnerable strategic centers of gravity. Although aerospace forces perform many crucial "force-enhancement" missions, one is uniquely important to the success of military air operations—air refueling. Air refueling has become indispensable in modern warfare. Air refueling capability ensures the unique flexibility of airpower (concentration of power quickly at any point on the globe against any facet of an enemy's power) is a reality rather than an abstract concept.

The Air Force has published doctrine supporting its objectives at the strategic, operational, and tactical levels. Several fundamental and enduring principles in Air Force doctrine provide guidance on Air Force organization and execution of the air war; however, not all Air Force flying operations are governed by doctrine publications. Strategic and tactical bombing, air-to-air combat, close air support, and airlift doctrine have been developed, published, and refined since their implementation, but air refueling doctrine has yet to be published.

This research paper proposes air refueling operations doctrine for the United States Air Force. The proposal offers a framework of fundamental concepts and doctrinal

principles that should be included in Air Force air refueling operations doctrine. Air refueling doctrine should be used to guide decisions regarding operational employment of tankers as well as decisions regarding tanker force sizing, future weapons acquisition, and technology integration. In offering air refueling operations doctrine, this paper reviews the history and evolution of air refueling, outlines the need to formulate and publish air refueling operations doctrine, analyzes fundamental concepts of aerospace doctrine, and addresses important factors shaping the content of air refueling doctrine. The proposed air refueling doctrine document is attached as Appendix A.

PROPOSAL FOR

UNITED STATES AIR FORCE

AIR REFUELING OPERATIONS DOCTRINE

I. Introduction

With 2,000 years of examples there is no excuse for not fighting a war well.
T.E. Lawrence (Lawrence of Arabia)

Airpower was first envisioned by military leaders as a tool to enhance the performance of surface forces. Military commanders saw the flimsy flying machines built by the Wright brothers and others primarily as tools for observation—a means to see over the next hill, to watch enemy movements, and to assist in the adjustment of artillery fire. This role had already been explored with static observation balloons in the Napoleonic Wars, the American Civil War, and the Spanish-American War. It is not surprising, therefore, that the first American military aviators and aircraft became part of the Army Signal Corps in August 1907 (Ordonez, *Essay S*, 1995:13-5).

The role of airpower rapidly expanded during World War I as many new combat and combat support missions were pioneered. Since the Great War, the role of airpower has expanded into almost every area of military activity. More than an equal partner with land and sea forces, airpower and aerospace power not only wage war in their own domains but also provide capabilities that "enhance" all forms of military power.

Although aerospace forces perform many crucial "force-enhancement" missions, one is uniquely important to the success of military air operations—air refueling. Air refueling has become indispensable in modern warfare. Air refueling capability ensures the flexibility, versatility, and synergy of airpower (concentration of power quickly at any point on the globe against any facet of an enemy's power) is a reality rather than an abstract concept. Air refueling makes possible intercontinental strategic airlift and strategic bombing operations that in some cases can not be accomplished without the use of forward air bases. Any air refuelable aircraft can increase its payload (whether cargo or munitions), without sacrificing range, by trading fuel load for payload and using air refueling capabilities. Even short-range fighter aircraft can respond nonstop to worldwide contingencies with the support of air refueling tankers. Adequate air refueling capability is of central importance to exploiting airpower's global flexibility.

Sufficient air refueling capability is no less important in short-range theater operations. Strike aircraft and combat support aircraft can extend their combat radius, lengthen their loiter time, carry heavier payloads in lieu of fuel, and still return to their operating bases with comfortable fuel reserves. In this sense, air refueling capability is a powerful "force multiplier" for theater commanders.

Purpose of This Research Paper

The purpose of this research paper is to propose air refueling operations doctrine for the United States Air Force. The proposed air refueling doctrine addresses "operational-level" doctrine versus strategic or tactical doctrine. This proposal is

intended to offer a framework of fundamental concepts and doctrinal principles that should be included in Air Force air refueling operations doctrine. Despite the importance of doctrine for air refueling operations it has yet to be formulated and published (Murin, 1996). In offering air refueling operations doctrine, this paper reviews the history and evolution of air refueling, outlines the need to formulate and publish air refueling operations doctrine, analyzes fundamental concepts of aerospace doctrine, and addresses important factors shaping the content of air refueling doctrine.

Air refueling operations doctrine ultimately supports basic aerospace doctrine—what we believe and teach is the best way to employ and support aerospace forces. Developing and publishing air refueling operations doctrine is important because commanders and military planners who are not familiar with air refueling operations need a tool to guide their decisions about utilizing and managing air refueling forces. Further, air refueling doctrine provides a formal document to codify lessons learned; hopefully, helping warfighting commanders avoid repeating mistakes made during previous air refueling operations.

Air refueling doctrine should be used to guide decisions regarding operational employment of tankers as well as decisions regarding tanker force sizing, future weapons acquisition, and technology integration. Unfortunately, many of these decisions are made without understanding the capabilities and limitations of the weapon system.

Following the introduction, chapter two presents the history and evolution of air refueling. Chapter three states the need for formulating and publishing operational air refueling doctrine, emphasizing three important reasons: no formal air refueling

operations doctrine exists; the demand for air refueling exceeds supply; and the need for commanders to better understand the operating principles of air refueling forces. Chapter four discusses fundamental concepts of aerospace doctrine, highlighting three distinct levels—strategic, operational, and tactical. Chapter five presents a conceptual model used to formulate doctrine and applies the model to propose air refueling operations doctrine (the proposed air refueling doctrine document is presented at Appendix A). The chapter also discusses five driving forces shaping the development and content of air refueling doctrine, notably: the end of the Cold War with the former Soviet Union; Air Force restructuring; emphasis on joint and multinational military operations; expanding tanker missions; and the need to outline air refueling command and control relationships. Chapter six concludes with a summary of the paper. Since a significant source of doctrine is what we have learned about aerospace power and its application since the dawn of powered flight, the following chapter reviews the history and evolution of air refueling.

II. History and Evolution of Air Refueling

To effectively look ahead and plan for the future, one must understand the past. History provides examples that illustrate how air refueling supports basic aerospace doctrine. Understanding how these events contribute to the enhancement of aerospace power is essential if the Air Force is to employ airpower effectively. The employment of air refueling demonstrates the flexibility, versatility, and synergy of aerospace power as described in AFM 1-1, *Basic Aerospace Doctrine of the United States Air Force*. The "force-enhancement" benefits provided by employing air refueling forces are described in this chapter. In many cases, past experience provides the foundation for doctrine because it often tells us what works and what does not work. "Experience carries us beyond the visions and speculations of theorists. Actual experience reveals that which is practical" (Holley, 1995:8). Capturing these lessons in a useable document is the challenge for doctrine writers if aerospace power is to fully exploit the contributions of air refueling.

Air refueling has its direct antecedents in naval coaling stations. Coal-fired ships of the late nineteenth and early twentieth century required a network of coaling stations (or access to those stations) if navies were to have global-reach ability. The advent of oil-fired ships and underway refueling capabilities lessened the requirement for shore-based refueling stations. In the air, analogous developments took place as frequent fuel stops on long flights were slowly eliminated by production of longer-range aircraft, provision of auxiliary fuel tanks ("drop" tanks on many combat aircraft), and the development of underway refueling capabilities in the form of air refueling.

In 1918, Lieutenant Godfrey L. Cabot, a United States Navy Reserve pilot, began snaring bags of sand positioned on floats as a test of the viability of putting fuel on ships in such a way that aircraft could grab it on nonstop transatlantic flights. From this early experiment with a grappling hook and a five-gallon can, the seeds of air refueling grew in the 1920s. While many of the early air refueling events were stunts and attempts at endurance records, significant strides were made in an area of flight which would soon bring aviation toward its potential and revolutionize the transportation of people, cargo, and military power (*70 Years of Air Refueling*, 1990:1).

On 21 November 1921, Wesley May, a wing walker with a five-gallon can of gasoline strapped to his back, climbed from an airborne Lincoln Standard aircraft to a JN-4 aircraft and poured the gasoline into the tank of the second aircraft. This Long Beach, California, publicity stunt is considered the first "air-to-air" refueling on record (Brunkow, 1994:3).

Major Henry H. "Hap" Arnold was one of the first military officials to recognize that air refueling could solve early aviation problems with flight endurance and payload. On 20 April 1923, under the direction of Major Arnold, two Army Air Service De Havilland DH-4Bs performed the first in-flight hose contact (Figure 1). Although no fuel transferred during the 40-minute test at San Diego, California, the modified tankers demonstrated the feasibility of gravity-flow air refueling (Brunkow, 1994:4).

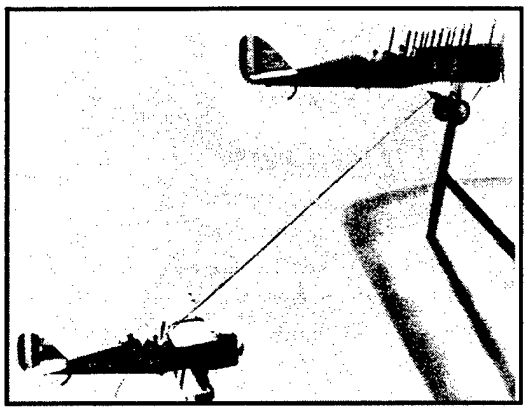

Figure 1. De Havilland DH-4Bs Perform First Air Refueling Test (Byrd, 1994:33)

On 27 June 1923, the Army Air Service conducted its first successful air refueling. Captain Lowell H. Smith and Lieutenant John P. Richter set new marks for duration and distance. The 6-hour and 38- minute flight of a DH-4B at San Diego was made possible through two hose refuelings by a second DH-4B (Byrd, 1994:21-22).

Throughout the mid-1920s numerous air refuelings were accomplished and new endurance records were set. Despite the Army Air Service's contribution to air refueling exploration, air refueling still was not regarded as the acceptable method to overcome endurance and payload problems. This changed, however, when the "Question Mark" landed on 7 January 1929.

In January 1929, in a test of both the practical value of air refueling and crew and aircraft endurance, a modified Atlantic (Fokker) C-2A, the "Question Mark," established a world duration record of 150 hours, 40 minutes, and 15 seconds—almost 6 days of non-stop flying and the equivalent of 11,000 miles. The Army Air Corps' high-wing, trimotor monoplane had been specially outfitted with a large capacity fuel tank in the cabin for receiving fuel, and lines and hand-operated pumps for transferring the fuel to the wing

tanks. The tankers, two modified Douglas C-1 biplanes, were each equipped with two 150-gallon cabin tanks and a 40-foot fueling hose. Shuttling in the airspace between Santa Monica and San Diego, California, a distance of approximately 110 miles, the tankers made 143 contacts with the "Question Mark," allowing it to remain airborne until engine problems forced it to land. Tanker-receiver contacts averaged 7.5 minutes and a total of 5,700 gallons of fuel was transferred through the 1.75-inch diameter hose (Figure 2). Oil, food, water, and other items were also passed during the refueling contacts. The transfers occurred as both aircraft flew at approximately 80 miles per hour, at a separation of 15 to 20 feet (*70 Years of Air Refueling*, 1990:2).

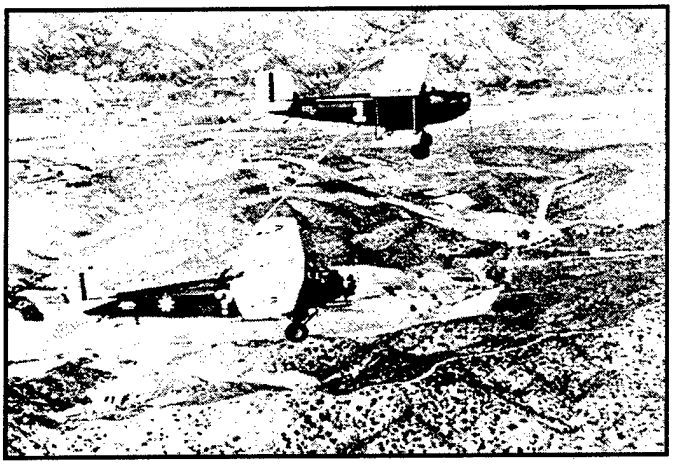

Figure 2. Flight of the "Question Mark" (*70 Years of Air Refueling*, 1990:2)

Major Carl Spaatz, as the commanding officer of the flight, pointed out that:

> From a military standpoint the successful demonstration of air refueling means that bombing planes can now take off with heavy loads of bombs and little gasoline, aerial refuel, and continue to a more distant objective than would otherwise have been possible. (Ryan, 1992:2)

Without doubt the flight of the "Question Mark" was a milestone in the development of early aviation and led to further experiments and interest in air refueling.

Civilian Interest in Air Refueling

For the remainder of 1929 and through 1932, the civilian community became interested in air refueling and one Englishman foresaw its potential. Civilian interest in air refueling, however, was centered around using air refueling as a means to break endurance records and not to develop air refueling per se.

R.L.R. Atcherly, a Squadron Leader in the Royal Air Force, witnessed an air refueling while in the United States and took the idea to Great Britain with plans of his own. After experimentation, Squadron Leader Atcherly developed his technique for air refueling, and, more important, caught the interest of Sir Alan Cobham, who, in 1936, formed the first private company devoted solely to the development of air refueling. The company, Flight Refueling Limited, after several years of experiments and limited trans-Atlantic operations, developed the expertise that would serve as the foundation for air refueling in future years (Ryan, 1992:2). Unfortunately for air refueling, in 1939 the immediate task at hand for the British became the Germans and World War II.

Air Refueling During World War II

With Britain's, and then America's, entry into World War II, military experimentation with air refueling picked up; however, because air refueling would be extremely difficult for the mass night bomber attacks, air refueling was not employed (Ryan, 1992:2). Although neither Britain nor the United States employed air refueling

operationally during the war, the array of possible applications for military operations gave impetus to studies and tests of new equipment.

In 1941, the United States wanted to develop a long-range bombardment capability to retaliate against Japanese aggression. However, due to United States' production of the B-29 Superfortress and its long-range bombing capability, significant developments in air refueling did not occur. The dropping of the atom bomb in 1945 brought the war to and end and interest in air refueling had shifted from endurance attempts to developing a real military strategic capability (Ryan, 1992:2). The age of strategic warfare was just beginning, and along with it came a renewed United States interest in air refueling.

Evolution of Strategic Air Refueling

After World War II, the United States saw the need for employment of strategic nuclear weapons. The United States Air Force believed the ability to reach out and bomb targets around the globe would be accomplished by using strategic airpower. In response to this need Strategic Air Command (SAC) was established on 21 March 1946. General Carl Spaatz, Commanding General of the Army Air Force, articulated its mission: "Be prepared to conduct long-range offensive operations in any part of the world, either independently or in cooperation with land and naval forces" (Ryan, 1992:3).

Strategic Air Command (SAC), established as one of three major combat commands of the Army Air Forces, became a major command of the new United States Air Force (USAF), which was created in 1947. Among its missions, which included

long-range offensive operations, reconnaissance, and the maintenance of strategic forces throughout the world, Strategic Air Command became the early focal point for United States Air Force air refueling operations (*70 Years of Air Refueling*, 1990:12).

Strategic Air Command decided that air refueling was the only answer to achieving global-reach capability. Accordingly, 25 years after Captain Smith and Lieutenant Richter proved air refueling was feasible, the United States Air Force turned to Flight Refueling Limited and Boeing Airplane Company for help. Strategic Air Command ordered appropriate hose/drogue equipment from Flight Refueling Limited to convert 100 B-29s to receivers and 60 B-29s to tankers. Boeing Airplane Company was awarded a contract to install the British hose-type equipment. Priority was given to the project as the United States Air Force and the United States Navy competed to show the United States Congress who was better suited for executing the strategic nuclear war (Ryan, 1992:3).

Following a demonstration flight on 24 March 1948 of air refueling between two B-29 aircraft, Congress was convinced of the merits of air refueling and its role in strategic nuclear war. Accordingly, Strategic Air Command and the Air Force were tasked with the responsibility to deliver the atom bomb, if need be (Ryan, 1992:3).

In 1948, Headquarters USAF directed Air Materiel Command to study and develop new methods and equipment for air refueling of bombardment aircraft, with $1 million of fiscal year 1948 research and development funds allocated for the project. SAC was given responsibility for conducting all operational suitability tests. According

to SAC, the current hose-type fuel transfer equipment used for air refueling was not compatible with evolving jet aircraft. Boeing was asked to provide a better air refueling system, one that could provide faster flow rates at higher altitudes and higher airspeeds, eliminating the need for receivers to decelerate and descend to lower altitudes to conduct air refueling operations. Air Materiel Command asked Boeing to proceed immediately with development of a uniquely American air refueling method, the flying boom (*70 Years of Air Refueling*, 1990:12).

While awaiting development of the new air refueling system, Headquarters USAF contracted with Boeing for modification of an additional 80 of Strategic Air Command's B-29s for air refueling, 40 as tankers and 40 as receivers. Simultaneous with the B-29 modification program at Boeing's Wichita, Kansas, plant, the command placed selected crews from the 43d and 509th Bombardment Groups on temporary duty at Wichita for air refueling orientation and training (*70 Years of Air Refueling*, 1990:13).

At the end of 1948, an Air Materiel Command staff study report on the benefits of air refueling for long-range bomber missions found that a single air refueling contact on the way to a target would increase the range of a B-29 with a 10,000 pound bomb load to 2,700 miles. One air refueling in each direction would result in a range of 3,400 miles, an increase of more than 75 percent over the non-air refueled radius of 1,950 miles.

As a result of being tasked with delivery of the atomic bomb, Strategic Air Command wanted to prove its worldwide capability and did so with a B-50 named "Lucky Lady." On 26 February 1949, the aircraft lifted off from Carswell AFB, Texas,

and after being air refueled four times by KB-29 tankers at various points, returned after circling the globe (Figure 3). The nonstop flight took approximately 94 hours, covered 23,108 miles, and clearly demonstrated Strategic Air Command's long-range offensive capability and highlighted the importance of air refueling (Ryan, 1992:3).

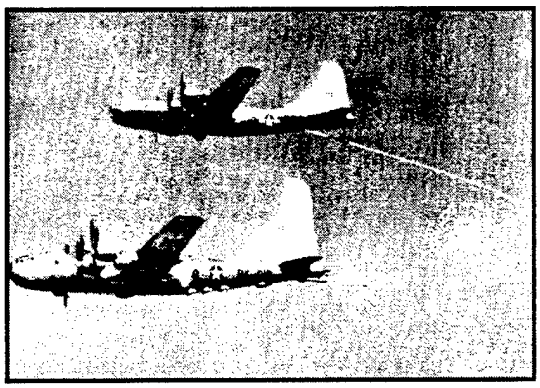

Figure 3. KB-29 Air Refueling the "Lucky Lady" (Brunkow, 1994)

After extensive testing and development of a new air refueling system, Boeing introduced the flying boom. The boom was capable of transferring fuel at three times the rate as the hose-type system, and at higher altitudes and airspeeds. By 1 September 1950 the flying boom was ready to join the active inventory and did so on a KB-29P at Biggs Field, Texas. Prior to this, all KB-29 tankers were equipped with the British-made hose-type air refueling system. The flying boom marked the beginning of air refueling modernization for Strategic Air Command (SAC) and led to the establishment of more capable tankers.

After the introduction of the KB-29 in the late 1940s, SAC began to receive the KC-97 in 1951. The KC-97, with the flying boom, was capable of flying fast enough and high enough to refuel the new B-47. The KC-97's capability to air refuel at higher

altitudes and airspeeds was a big step in the evolution of air refueling because receivers were no longer required to decelerate and descend to lower altitudes to conduct air refueling operations. The result was a savings in time and fuel consumption, because the receiver did not have to decrease altitude to obtain fuel, and return to cruising altitude following the air refueling. The KC-97, with its high altitude, high airspeed air refueling capability ushered in a new era of air refueling and it gave the B-47 a truly intercontinental bombing role (Figure 4). The KC-97 remained the primary tanker for SAC until 1957, at which time the KC-135A began to enter the inventory (Ryan, 1992:3).

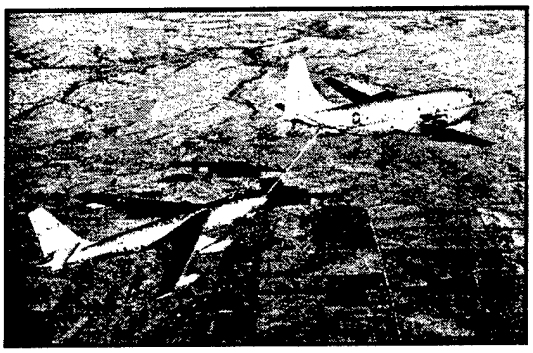

Figure 4. KC-97 Air Refueling a B-47 (Byrd, 1994:99)

The acquisition of the Boeing KC-135 was the beginning of the golden age for air refueling (Figure 5). The KC-135 significantly increased the capability of the Air Force's tanker fleet. During air refueling, and with all fuel pumps on, the fuel will flow out the boom at a rate of nearly 1,000 gallons per minute. This is in contrast to the KB-50s 300 to 500 gallon per minute rate of flow (Byrd, 1994:109). As the Air Force moved toward an all-jet powered tanker fleet, the need no longer existed for slower tankers to be positioned along the route of flight far in advance of the actual movement of aircraft.

This factor alone reduced the overall reaction time for a mobile strike force by a considerable amount of time, estimated to be between 12 and 24 hours (Byrd, 1994:111).

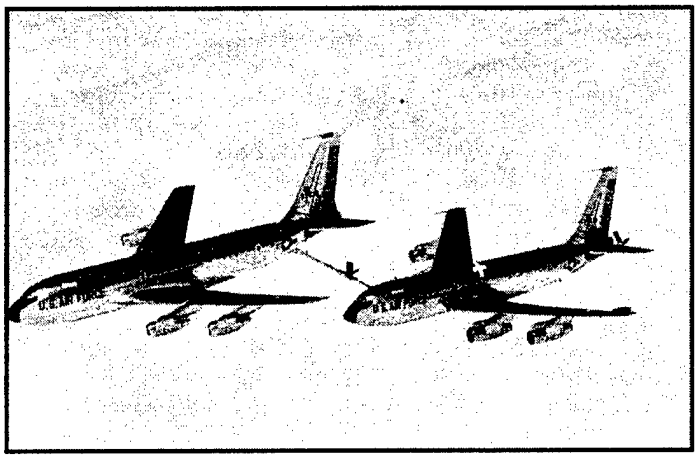

Figure 5. KC-135A Air Refuels EC-135C (Byrd, 1994:110)

From the initial introduction of tankers in 1948 up until 1957, Strategic Air Command had grown from 2 air refueling squadrons to 40 squadrons. During this period air refueling had grown from an unaccepted concept to the production of tanker-specific aircraft; and by the end of 1957 its 766 tankers comprised over 39 percent of the Strategic Air Command's total aircraft inventory (Ryan, 1992:4).

Tactical Air Command

The flying boom eventually became the standard for Strategic Air Command. Tactical Air Command (TAC), however, took another path and, after working with Britain's Flight Refueling Limited, began to use a hose-drogue fuel transfer method for its single-seat fighters. Consequently, in the early 1950s the United States Air Force began to develop two different and incompatible methods of air refueling: the flying boom method for SAC and the hose-drogue method for TAC (Ryan, 1992:3).

Unfortunately, the decision to equip tankers with boom versus hose-type fuel transfer systems imposes limitations on today's joint (interservice) and combined (multinational) air refueling operations because Navy and Marine air forces, and most foreign air forces, utilize hose-type refueling equipment on their receiver aircraft. Moreover, SAC's emphasis on high fuel transfer rates overshadowed TAC's air refueling constraint of too few booms. As it turns out, combat air forces are concerned not only with the speed of fuel transfer but, more important, the need to air refuel more than one aircraft at the same time, reducing the amount of time spent conducting air refueling operations.

Realizing its need for tankers, TAC obtained old KB-29s and KB-50s with probe and drogue capability. However, neither the KB-29 nor the KB-50 bomber satisfied TAC's need for high-altitude, fast-moving tankers. To help alleviate TAC's problem, the drogue adapter kit was developed to allow probe-equipped fighters to refuel from SAC's boom-equipped KC-135s. The device, a rubber hose hooked onto the end of the boom, had a drogue (basket) located on the end. However, its inherent drawback was that the modification had to be done on the ground prior to flight and when completed allowed only probe-equipped aircraft to air refuel (Ryan, 1992:4).

Naval Air Force Tankers

The United States Navy was convinced air refueling would significantly increase its operational capability and realized the USAF did not have excess tankers to support Naval air force air refueling requirements. In response to their requirement for air

refueling, the Navy conducted air refueling tests at the Naval Air Test Center and began to either modify existing fighters or to configure production fighter aircraft with probe-drogue equipment. The Navy converted AJ bombers to tankers by replacing the bomb bay with fuel tanks (Ryan, 1992:4).

In 1957, the Navy replaced the AJ tanker, as its size required a large amount of carrier deck space. The replacement tanker was the AD-6 aircraft that had been converted into a "buddy" tanker role. Under the buddy air refueling concept, a small attack-type aircraft, such as the A-6 Intruder, was configured with a belly-mounted drogue and reel system. Additionally, all A-6 aircraft aboard a carrier were equipped with a buddy store, enabling it to act as a tanker. Operating as a tanker, however, the KA-6D had limited refueling ability, as compared to SAC's large land-based KC-135 tankers. Further, each A-6 that is performing as a tanker loses its attack capability (Ryan, 1992:4).

The decade of the 1950s brought about a proliferation of air refueling assets within the Air Force and the Department of the Navy. Unfortunately, each service acted independently without regard to interoperability or joint use. The Air Staff realized the problem and in 1959 proposed an alternative solution (Ryan, 1992:5).

Single Manager System

The Air Staff provided the alternative in November 1959 and aimed it at ensuring responsiveness to all users. The proposal, Department of Defense Instruction 5160.12, asked Strategic Air Command to develop a single manager system that would ensure a standard air refueling system for the Air Force. The proposal outlined two objectives:

eliminate any duplication of effort within the Air Force and improve the efficiency of operations within the Department of Defense. As an outgrowth of the efficiency objective, General Curtis LeMay also decided that all bomber aircraft and all future Air Force fighters would be equipped with a boom receptacle. The decision closed the loop, as today all Air Force aircraft use the boom-type refueling method. The policy came into effect on November 1961. The Strategic Air Command single manager system, using a combination of KC-135 and KC-10 tanker aircraft, has grown from serving only SAC and TAC in the 1960s to serving the Navy and Marines and allied nations in the 1990s (Ryan, 1992:4).

Evolution of Theater Air Refueling

Air refueling proved its worth for tactical aircraft in Southeast Asia. Until the Vietnam conflict KC-135s were traditionally viewed as strategic tankers, primarily mated to their emergency war order bombers (B-52s). In fact, the first combat-support use of KC-135s and air refueling occurred over South Vietnam on 9 June 1964, when four KC-135s refueled eight F-100s and started a new era for air refueling. From this point on Strategic Air Command's KC-135s were used to support daily combat operations. In the 9 years and 2 months of operations in Southeast Asia, KC-135s provided 813,878 air refuelings and transferred over 1.4 billion gallons of jet fuel. In support of tactical aircraft alone, KC-135s provided 756,970 (93 percent) air refuelings (Ryan, 1992:5).

During the Vietnam War, KC-135 tankers made numerous aircraft "saves." A save occurred when a receiver was unable to return to base due to combat damage or

inadequate fuel to reach the point of intended landing. The most famous example was a three-aircraft air refueling. In May 1967, a KC-135 equipped with a drogue obtained a request for an emergency air refueling from the Navy to help an A-3 aircraft (Navy tanker capable of offloading fuel in flight) who was short of fuel. As the KC-135 responded, another Navy airplane, an F-8, also became short of fuel. After the rendezvous with both Navy aircraft, the KC-135 tanker found itself passing fuel to the A-3, which was passing fuel to the F-8 at the same time! (Ryan, 1992:5)

Not only did KC-135s provide tactical air refueling support during the Vietnam conflict, they also provided commanders with the key to airpower—flexibility. Fighter aircraft could now strike deeper into enemy territory, carry more munitions, and remain on station for increased periods (Hopkins, 1979:4).

In effect, air refueling matured during the Southeast Asia conflict. The tremendous accomplishments ensured air refueling would be an integral part of United States Air Force tactical operations. The conflict also highlighted the need for more Air Force and Navy joint doctrine, tactics, and operations. For many reasons joint air refueling operations were not planned during the Vietnam War, but two stand out. First, both services operated independently. Second, the Navy had their own buddy tanker fleet. Because of these factors joint Air Force and Navy operations did not evolve. After the war, military planners in both services began to realize that increased capabilities could be achieved from a tanker equipped with a boom and hose/drogue air refueling system (Ryan, 1992:6).

Introduction of the KC-10

An increase in the number of receiver aircraft in the late 1970s, the desire to improve interoperability with the Navy, and the need for an advanced tanker to meet future air refueling requirements led to the development of the KC-10 tanker (Figure 6). The KC-10 offers several advantages over the KC-135. For example, a deployment of 12 F-15s to the Persian Gulf would require 16 KC-135s, 5 airlift aircraft, and the use of forward bases in Spain and the Azores to complete the deployment, and would necessitate a stop-over at one point, probably the Azores. Only six KC-10s would be needed to complete the deployment: no C-141s, no C-5s, no forward bases used, the deployment could be done in 1 day, and the fuel saved would amount to 600,000 gallons (Byrd, 1994:194).

Of all the enhancements desired, one stood out as being able to provide maximum flexibility and interoperability. This enhancement called for the new-generation tanker to have both a boom and a hose-drogue assembly installed; unlike the KC-135, which permits only one method of fuel transfer after takeoff. When completed, the advanced tanker would allow either Air Force, Navy, or Marine aircraft to air refuel from a single airborne tanker, improving interoperability between Services. Additionally, the tanker itself was to be manufactured with a refueling receptacle, allowing it to perform as a receiver and to onload fuel from another tanker. The Defense Department awarded McDonnell Douglas Company a contract to build a military version of the DC-10,

designated the KC-10 "Extender," and by the end of 1988 a total of 60 KC-10s had been built (Ryan, 1992:6).

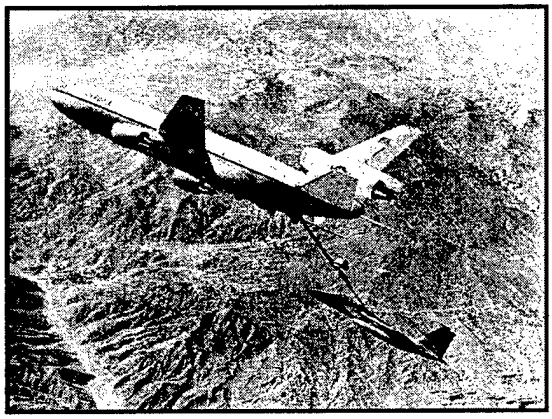

Figure 6. KC-10 "Extender" (Byrd, 1994:192)

As the KC-10 was being procured, personnel from the Air Force and Navy were aware of the need to improve interoperability and compatibility for the enhancement of combat effectiveness. As a result the Services, in 1981, signed a memorandum of understanding which listed provisions to ensure interservice compatibility, thus paving the way toward more joint agreements and making a significant step toward a joint, flexible, and combat-effective force (Ryan, 1992:6). In conjunction with this effort, and to meet the growing need for air refueling within a warfighting commander's regional theater, the Air Force, Navy, and Marines modified C-130 cargo aircraft into air refueling tankers.

C-130 Air Refueling Tankers

C-130 aircraft are used by Air Force, Navy, Marine, and multinational air forces, serving a dual mission as a tanker and cargo-type aircraft. These aircraft are very versatile, refueling strike aircraft, hauling cargo, and with its reversible propellers, can

land at fields with very short runways. In addition, probe-equipped C-130s can be air refueled by long-range tankers, and in turn, can then become tankers themselves by refueling combat and combat support air forces in a more localized area (Figure 7). The installation of an air refueling pod provides the flexibility for the dual-mission capability (Byrd, 1994:191).

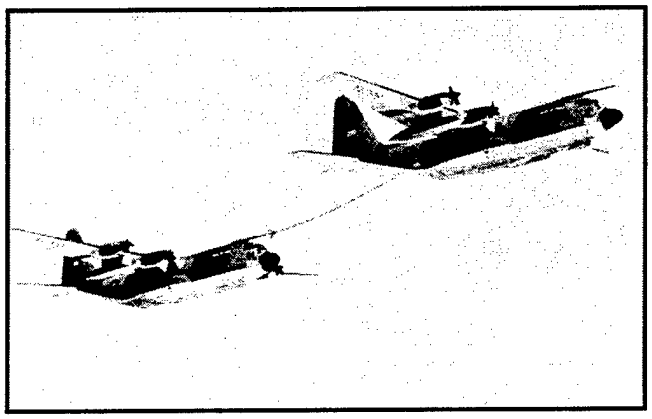

Figure 7. British C1 "KC-130" Tanker (Byrd, 1994:181)

Impact of Air Refueling During the Gulf War

These joint efforts and the large-scale investment in air refueling aircraft paid huge dividends during the Gulf War in 1991. During Operations DESERT SHIELD/STORM, Air Force tankers flew nearly 80,000 hours; offloading 178 million gallons of fuel to 60,500 aircraft. Twenty percent of these aircraft were Navy or Marine—truly a joint effort (Ryan, 1995:4).

Today, air refueling capability ensures that the unique flexibility of airpower is a reality. As a force multiplier, tankers increase the ability of aerospace forces to perform their mission. Air refueling increases the ability of aircraft by extending their range,

payload, and endurance. Air Force Manual 1-1, Volume I, *Basic Aerospace Doctrine of the United States Air Force*, states:

> Sufficient air refueling capability must be available to exploit aerospace power's unique flexibility. The ability of aerospace power to concentrate force anywhere against any facet of the enemy may depend on sufficient air refueling capability. (AFM 1-1, Vol. I, 1992:14)

Having presented the history and evolution of air refueling, the following chapter discusses the need for operational air refueling doctrine. A lack of codified air refueling operations doctrine, increased demand for air refueling, and a need to better understand the operating principles of air refueling forces are driving factors behind the need for air refueling doctrine.

III. The Need for Air Refueling Operations Doctrine

Doctrine is important because it provides the framework for understanding how to apply military power. It is what history has taught us works in war, as well as what does not. Doctrine is valuable for those in field units and to those in headquarters, to those in operations and to those in support areas, to those who understand air and space power and to those who are just learning.

General Merrill A. McPeak, USAF
Chief of Staff, 1992

The Air Force has published doctrine supporting its objectives at the strategic, operational, and tactical levels. Several fundamental and enduring principles in Air Force doctrine provide guidance on Air Force organization and execution of the air war; however, not all Air Force flying operations are governed by doctrine publications (USAFEP 50-38, 1994:B-1). Strategic bombing, air-to-air combat, close air support, and airlift doctrine have been developed, published, and refined since their implementation. Despite the importance of air refueling operations doctrine to teach and prescribe the best operational use of air refueling, its development has not been formalized and it has not been published (HQ USAF/XOXD, 1996).

There are at least three important reasons to formulate and publish air refueling operations doctrine: (1) no formal air refueling operations doctrine exists, (2) the demand for air refueling exceeds supply, and (3) a need for commanders to better understand operating principles of air refueling forces.

Lack of Published Air Refueling Doctrine

Major Daniel J. Monihan, in his graduate research paper, *Creating Air Refueling Doctrine: Preserving Experience in Writing*, concludes that air refueling doctrine has yet to be published. Without clear, concise, functional, documented air refueling doctrine, an incomplete understanding of air refueling's contribution to airpower degrades operational effectiveness and may result in failure of the mission (Monihan, 1996:4). Not only is there a lack of codified air refueling doctrine there is also a short supply of tanker forces required to meet the demand for air refueling.

Demand for Air Refueling Exceeds Supply

In answering the question "Why Operational Air refueling Doctrine?" Major Len Murin from the Air Force Doctrine Center states:

> The reason is because there are never enough air refueling assets to meet requirements, including joint and multinational air refueling demands. Further, there is a need for operational doctrine across Service components. We need to understand the operating principles of all air assets to operate efficiently and effectively. Without doctrine Service components are not equipped to understand the operating principles in the joint arena. This can have a negative effect on command and control arrangements, planning, programming and budgeting, and efficient utilization of tanker resources. (Murin, 1996)

Another factor driving the need for air refueling doctrine is that demand for air refueling support exceeds supply during critical phases of major air campaigns. Illustrating the impact of limited air refueling assets on air, and ultimately, ground operations, Douglas Menarchik, in his book *Powerlift–Getting to Desert Storm*, discusses

the allocation of air refueling tankers during the deployment phase of Operation DESERT SHIELD. Menarchik writes:

> The competition for tanker air refueling delayed for several days the arrival of Marine aircraft that supported Marine ground operations. Central Command gave tanker priority to deploying Air Force units. The Marines were concerned, since they relied on these aircraft for much of their combat power. (Menarchik, 1993:126)

Consequently, while thousands of Marines were already in Saudi Arabia, the Marine Corps' F/A-18 fighters, needed to support them in combat, were sitting on a runway in Cherry Point, North Carolina. The fighters could not reach the Arabian peninsula without air refueling, which only the Air Force could supply. Air Force aerial tankers, however, were assigned solely to air refuel Air Force fighters (Grossman, 1991:1).

In another example Menarchik illustrates the impact of limited air refueling assets on airlift operations during Operation DESERT SHIELD:

> General H. T. Johnson, Commander, Military Airlift Command, directed that the first airlift missions transporting the "ready forces" be air refueled so that they could be flown nonstop to the Gulf. A fairly small number of strategic airlift missions were air refueled during the first two weeks, however, since the Air Force heavily committed the tankers to air refueling tactical fighter aircraft en route to the Gulf. In this case, General Schwarzkopf, Commander-in-Chief, US Central Command, sacrificed airlift deployment speed for mobility of Air Force fighters and firepower. (Menarchik, 1993:126)

Not only is it important to properly allocate air refueling forces in support of Air Force theater and strategic missions, it is important to consider the allocation of air refueling to customers outside the Air Force, including Navy and Marine air forces.

Equally important, however, is the educational value of air refueling operations doctrine for military planners and commanders, most importantly, the warfighting commander.

Educate Commanders

Another factor influencing the need for air refueling operations doctrine is a need for commanders (Army, Navy, Air Force, and Marine) to better understand the operating principles of air refueling forces. In a recent discussion on airpower Air Force Chief of Staff General Ronald R. Fogleman acknowledged that "it's important to understand how best to employ airpower" (Baldwin, 1996:1). To this end, air refueling doctrine is essential to guiding military planners in supporting the Air Force's mission of *Global Reach–Global Power*. General Fogleman closed his discussion by stating "commanders must be able to articulate how best to employ Air Force capabilities to gain a powerful advantage in time, mass, position, and awareness in pursuit of national security objectives" (Baldwin, 1996:2). Air refueling doctrine is the tool used to educate commanders (Army, Navy, Air Force, and Marine) and military planners about air refueling's "force-enhancement" capabilities. It helps bridge past experience and future expectations to achieve air campaign objectives. Moreover, air refueling operations doctrine will provide commanders with a guide for employing air refueling forces in support of United States' strategic and operational objectives.

This chapter should give the reader an appreciation for the need to formulate and publish operational air refueling doctrine. Department of Defense, Air Staff, and major command (MAJCOM) planners strive to properly allocate tanker forces and meet the demand for air refueling support. Understanding the history and evolution of air

refueling and outlining the need for air refueling doctrine are important steps towards developing United States Air Force air refueling operations doctrine. As a stepping stone to formulating air refueling doctrine, the following chapter presents a discussion of basic aerospace doctrine. Understanding basic aerospace doctrine and applying its concepts and principles provides the foundation for developing operational-level doctrine.

IV. Aerospace Doctrine

At the heart of warfare lies doctrine. It represents the central beliefs for waging war in order to achieve victory. Doctrine is of the mind, a network of faith and knowledge reinforced by experience which lays the pattern for the utilization of men, equipment, and tactics. It is the building material for strategy. It is fundamental to sound judgment.

General Curtis Emerson LeMay, 1968

Air Force Manual 1-1, Volume I, *Basic Aerospace Doctrine of the United States Air Force*, the cornerstone doctrinal manual, provides the framework from which the Air Force develops its operational doctrine contained in Air Force 2-series manuals. The Air Force publishes basic doctrine in Air Force 1-series manuals. As basic doctrine, AFM 1-1 states the most fundamental and enduring beliefs which describe and guide the proper use of aerospace forces in military action. Regrettably, discussions about doctrine often become shrouded in semantics that only theoreticians seem to be able to penetrate. That's unfortunate, because semantic arguments obscure the real issues, issues that doctrine alone addresses. Doctrine answers such questions as: "What do we believe?" "What do we do?" and "What should we do now?" (Ordonez, 1995:10-2).

The United States Air Force, the aerospace arm of the Armed Forces, has developed doctrine to guide and direct operations in the aerospace environment. The primary objective of air forces is to win the air battle in support of national military objectives—to gain and/or maintain control of the aerospace environment and take decisive actions against an enemy's identified centers of gravity. With this aim in mind, aerospace doctrine outlines the fundamental principles by which military forces or

elements thereof guide their actions in support of national objectives—it is authoritative but requires judgment in application (Joint Pub 3-0, 1995:i).

What Is Doctrine?

Air Force Manual 1-1, Volume I, *Basic Aerospace Doctrine of the United States Air Force*, defines aerospace doctrine as:

> Aerospace doctrine is, simply defined, what we hold true about aerospace power and the best way to do a job in the Air Force. It is based on experience, our own and that of others. Doctrine is what we have learned about aerospace power and its application since the dawn of powered flight. While history does not provide specific formulas that can be applied without modification to present and future situations, it does provide the broad conceptual basis for our understanding of war, human nature, and aerospace power. Thus, doctrine is a guide for the exercise of professional judgment rather than a set of rules to be followed blindly. It is the starting point for solving contemporary problems. (AFM 1-1, Vol. I, 1992:vii)

For many people, there is considerable confusion regarding the subject of doctrine. "Some of this confusion has resulted from ill-conceived doctrinal publications," says Colonel Dennis M. Drew, former Director for Research, Air University Center for Aerospace Doctrine, Research and Education (CADRE). Colonel Drew states, "the word doctrine conjures up confusion and consternation." In their book, *Making Strategy: An Introduction to National Security Processes and Problems*, Colonel Drew and Dr. Donald M. Snow state that "military doctrine is what we believe about the best way to conduct military affairs" (Drew and Snow, 1988:3). According to Major Len Murin, Chief, Mobility Doctrine, at the Air Force Doctrine Center:

> Aerospace doctrine is based upon historical experience, yet it is forward looking. Aerospace doctrine offers a standard to measure airpower's

> efforts. It is a guide for the exercise of judgment. Doctrine is authoritative and provides a baseline of reference. (Murin,1996)

Former Air Force Chief of Staff General Merrill A. McPeak said of doctrine, "Doctrine provides the framework for understanding how to apply military power. It is what history has taught us works in war, as well as what does not" (AFM 1-1, 1992:v).

Types of Doctrine

Part of the confusion about doctrine stems from the fact that there are three distinct types of doctrine. Colonel Drew and Dr. Snow categorize doctrine as fundamental, environmental, and organizational (Drew and Snow, 1988:3). Fundamental, environmental, and organizational doctrine are parallel terms for strategic/basic, operational, and tactical doctrine as described in Air Force Manual 1-1, Volume I, *Basic Aerospace Doctrine of the United States Air Force*.

Fundamental or strategic/basic doctrine forms the foundation for all other types of doctrine. Its scope is broad and its concepts are abstract. Essentially, fundamental doctrine defines the nature of war and the purpose of military forces. Most important, doctrine establishes a mindset and a way of thinking about employment of specialized forces. That is why it is imperative to have Air Force doctrine that espouses a distinct air-mindedness and is characteristically different from land or naval force doctrine (Murin, 1996). Fundamental doctrine is, for the most part, considered timeless. It seldom changes because it deals with basic concepts rather than contemporary techniques. In addition, fundamental doctrine is relatively insensitive to political philosophy or technological change (Drew and Snow, 1988:3).

Environmental or operational doctrine is a compilation of beliefs about the employment of military forces within a particular operating medium. Environmental doctrine has several distinctive characteristics. It is narrower in scope than fundamental doctrine because it deals with the exercise of military power in a particular medium. Environmental doctrine is influenced by such factors as geography and technology (Drew and Snow, 1988:3).

Organizational or tactical doctrine is best defined as basic beliefs about the operation of a particular military organization, weapon system, or group of closely linked military organizations. Typically, organizational doctrine discusses current objectives and force employment principles as they are influenced by the current situation or expected future situation (Drew and Snow, 1988:4).

Organizational doctrine has several salient characteristics that distinguish it from fundamental or environmental doctrine. Organizational doctrine is very narrow in scope. Organizational doctrine concerns the best use of a particular force in a particular environment at a particular time. In addition, organizational doctrine is current and must change to stay current. This tendency to change contrasts sharply with the almost timeless qualities of fundamental doctrine and the considerable staying power of environmental doctrine (Drew and Snow, 1988:4).

Organizational doctrine comprise the bulk of doctrinal publications. It has been further subdivided and specialized into doctrine for specific types of forces, types of conflicts, and other subcategories. As the content of these publications increasingly

narrows in scope, it assumes the characteristics of regulations or standard operating procedures (Drew and Snow, 1988:4).

Air Force Manual 1-1, Volume I, *Basic Aerospace Doctrine of the United States Air Force*, states that "war is planned and executed at three levels: strategic, operational, and tactical. These levels are dynamically interrelated" (AFM 1-1, Vol. I, 1992:2). Just as war is planned and executed at three levels, military doctrine is organized along those same three levels. Strategic-level doctrine incorporates the broadest concerns of national and military policy. Operational-level doctrine focuses on campaigns and the forces to accomplish strategic objectives. These objectives are achieved through design, organization, and conduct of campaigns and major operations that guide tactical events. Tactical-level doctrine focuses on battles and engagements (AFM 1-1, Vol. I, 1992:2). Joint Pub 3-0, *Doctrine for Joint Operations*, states: "the three levels of war (strategic, operational, and tactical) are doctrinal perspectives that clarify the links between strategic objectives and tactical actions (Joint Pub 3-0, 1995:ix).

Changes in Doctrine

An important source of doctrine is experience—things that have been successful in the past or lessons learned from history. Unfortunately, not all past experience is relevant to the present (not to mention the future), and there is no guarantee that what is relevant today will remain relevant in the future. Thus, doctrine is a constantly maturing and evolving process. According to Air Force Manual 1-1, Volume I, *Basic Aerospace Doctrine of the United States Air Force*:

> Doctrine should be alive—growing, evolving, and maturing. New experiences, reinterpretations of former experiences, advances in technology, changes in threats, and cultural changes can all require alterations to parts of our doctrine even as other parts remain constant. If we allow our thinking about aerospace power to stagnate, our doctrine can become dogma. (AFM 1-1, Vol. I, 1992:vii)

The history of warfare has shown that unless military forces are guided by appropriate doctrine, even superior numbers and advanced weapons are no guarantee of victory. Having outlined the history and evolution of air refueling, the need for air refueling doctrine, and the fundamental principles of aerospace doctrine, the following chapter presents proposed air refueling operations doctrine.

V. Proposed Air Refueling Operations Doctrine

Air refueling operations doctrine formulation is an important task. Hopefully, this paper is a step in that direction. Participation by the numerous organizations involved in the doctrine formulation process should be coordinated by the Air Force Doctrine Center. At a minimum the following organizations should be incorporated into the process: Air Force Doctrine Center, Air Mobility Command, Air Combat Command, representatives from the Navy, Marines, and North Atlantic Treaty Organization.

A robust means of both generating and evaluating air refueling doctrinal concepts, technologies, and theories must be accomplished. Following the creation of air refueling operations doctrine, subsequent updates and revisions should be accomplished. The process demands continuous review if the doctrine is to remain meaningful. This should be done at least annually to capture emerging concepts and coordinate the integration of new technology. An important goal of doctrine formulation is to accurately match future expectations with current planning and strategy. Continuous review will help achieve this objective. In this sense, air refueling doctrine is imperative to the success of future air refueling operations (Monihan, 1996:12).

The Doctrine Process Model (Figure 8) created by Colonel Dennis M. Drew, former Director for Research, Air University Center for Aerospace Doctrine, Research, and Education (CADRE), provides an excellent blueprint for the creation and revision of meaningful air refueling doctrine. Colonel Drew's model describes the process which can be used to guide the development of air refueling operations doctrine. A process that

responds to the fundamental Air Force doctrine question, What is the best way to use airpower? Using Colonel Drew's model, one can insert past experiences and theories about air refueling operations along with expectations about future requirements to formulate air refueling doctrine. Combined with changing technology and future expectations, our past experiences and current capabilities merge together to provide the starting point for developing air refueling doctrine.

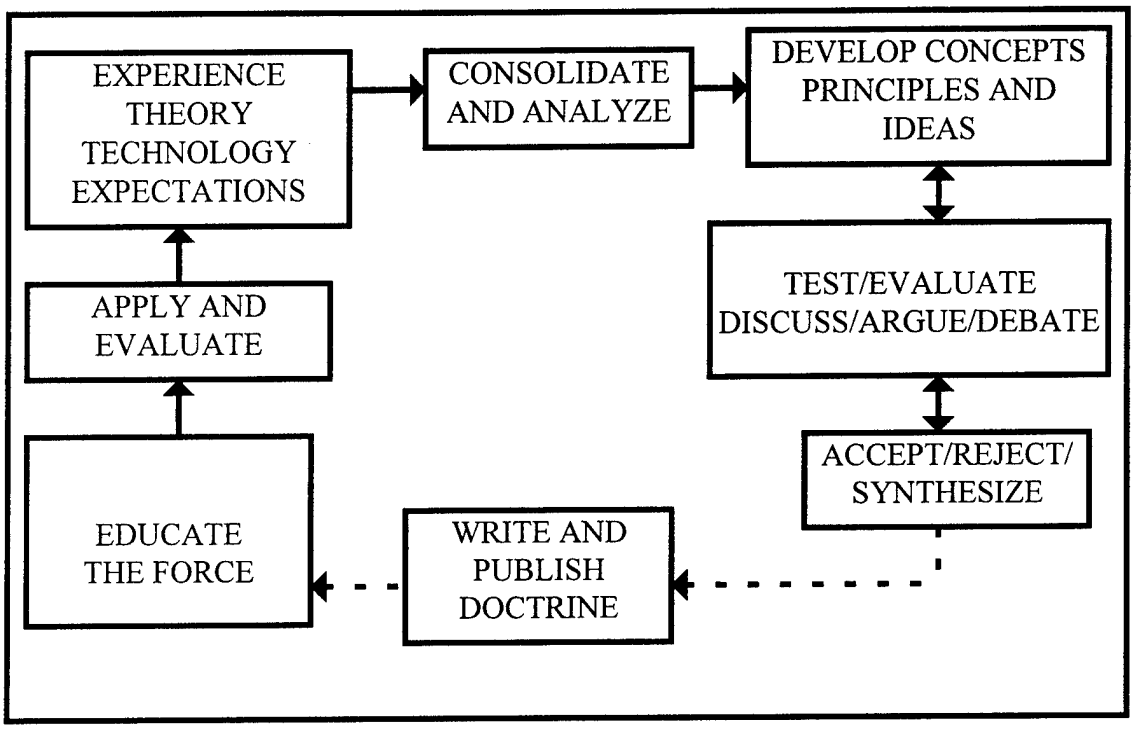

Figure 8. Doctrine Process Model (Drew, 1992:3)

Colonel Drew's Doctrine Process Model starts with a combination of experience, theory, and technology, to which I've added future expectations. It is important to anticipate and plan for the future so that doctrine is not playing "catch up" with the application of airpower.

Having presented a conceptual model that can be used to formulate doctrine, the following sections present support for the theories, concepts, and principles in the proposed air refueling operations doctrine. The document is presented as Appendix A at the end of the paper. The following sections address five driving forces shaping the development and content of air refueling doctrine: the end of the Cold War with the former Soviet Union; Air Force restructuring; emphasis on joint and multinational military operations; expanding tanker missions; and the need to outline air refueling command and control relationships. Understanding these dynamic factors is critical to formulating air refueling doctrine because they shape its content. The following section begins by looking at how the end of the Cold War with the former Soviet Union have reshaped United States' national and military strategic policy, ultimately impacting air refueling operations and the doctrinal principles that guide them.

End of the Cold War

It was not long ago that most military planners associated air refueling tankers with "alert," where bombers and tankers, along with land-based intercontinental ballistic missiles and a submarine fleet capable of launching long-range nuclear missiles, maintained 24-hour "alert." Under the United States strategic nuclear-deterrent plan, the Single Integrated Operational Plan (SIOP), air refueling tankers played a crucial role in air refueling bombers en route to their targets. The plan was designed to deter nuclear attack by the former Soviet Union; however, following the breakup of the Soviet Union and the collapse of the Berlin Wall, the United States pulled tanker and bomber crews off

24-hour "alert," and declared the end of the Cold War. Despite the end of the Cold War and significant reduction in bomber and tanker "alert" requirements, the United States still devotes a portion of bomber and tanker aircraft to the Single Integrated Operational Plan. Under the current plan Air Force bombers and tankers are prepared to respond to short-notice SIOP requirements in response to a nuclear threat to the security of the United States. Today, however, most military planners associate tankers with their expanding *Global-Reach* air refueling mission.

In June 1990, the Air Force published its first official statement of the Air Force role in national security since 1947. Within the Air Force it is simply called *Global Reach–Global Power*. The June 1990 White Paper laid out a vision of aerospace power and a strategic planning framework for the Air Force and outlined the principles of *Global Reach–Global Power*. In highlighting the importance of tankers to the goals and objectives of the Air Force, the White Paper concluded:

> Tankers are the lifeblood of global reach and global power. Air refueling assumes increasing importance as a force multiplier in a period of smaller forces and declining forward basing. Tankers build air bridges to sustain high rates of airlift to any point on the planet, sometimes flying more sorties than the airlifters. Strike packages rely on tankers to extend range and payload, and guarantee air forces the global reach to deploy rapidly and to employ effectively. Land-based tanker forces are indispensable to support a range of theater air operations. In Southwest Asia, joint United States and Coalition forces depended on USAF tankers for operations beyond the littoral. Due to these requirements, tankers and airlifters have received a proportionally smaller cut than other elements of our force structure. (DoAF, 1990:13-43)

Changing world events, initiated by the end of the Cold War and breakup of the former Soviet Union, have reshaped United States' national and military strategic policy,

which in turn is reshaping the utilization of air refueling assets. In a few short years, the focus of United States' national strategic policy has shifted from fighting the Cold War to supporting international humanitarian relief efforts and combating social instability. Today, airlift and air refueling forces are at the forefront of humanitarian relief operations and cover the front pages of world newspapers. Changes in world events, like the end of the Cold War, shape the formulation of air refueling operations doctrine as well as changes in the Air Force's organizational structure.

Air Force Restructuring

In 1991, General Merrill A. McPeak, Air Force Chief of Staff, initiated sweeping changes in the Air Force structure (AF Restructure, 1991:11). The reorganization has reshaped the utilization of tankers and consequently the emphasis on the missions they perform. One overriding theme of the restructure is *Global Reach–Global Power*. Under this new charter, air refueling forces provide the speed and flexibility in deploying and employing airlift, combat, and combat support missions.

In June 1992, under the restructuring, a majority of Air Force tankers were transferred from the former Strategic Air Command to Air Mobility Command (AMC). Consequently, AMC has made tankers much more available to support airlift aircraft in their *Global Reach* mission versus their more traditional fighter and bomber receivers. In contrast, prior to joining AMC, tankers were owned and managed by the former Strategic Air Command (SAC). As the single manager of all KC-135 and KC-10 tankers, SAC dedicated them to bomber aircraft first, leaving the former Military Airlift Command

(MAC) to compete against the former Tactical Air Command (TAC) for scarce tanker air refueling support.

Under the restructuring, United States Transportation Command (USTRANSCOM) has been designated the DoD single manager for transportation (other than theater-assigned and Service-unique assets). The primary Air Force component of USTRANSCOM is AMC, which is tasked with providing common-user strategic air refueling for the DoD and other government agencies. AMC executes air refueling missions employing air assets assigned to USTRANSCOM supporting DoD-wide users. AMC organizes, trains, equips, and provides operationally-ready air refueling forces, both active and reserve, for these worldwide strategic missions. Further altering the structure of the Air Force and utilization of tanker forces is the changing composition of active duty, Air National Guard, and Air Reserve forces in response to cuts in military spending.

Air Reserve Component Tanker Forces. Following the end of the Cold War the United States Government made significant cuts in the military budget, resulting in significant reductions of military forces. Active duty force end strengths are at their lowest levels since the beginning of World War II. As part of the downsizing initiative, over half of the Air Force's air refueling forces (67 percent of KC-135 aircrew members and 76 percent of maintenance personnel) were transferred to Air National Guard and Air Reserve units, commonly referred to as Air Reserve Component (ARC) forces (AMMP, 1996:3-9). The current mix of active duty and ARC forces will likely change, with an even greater percentage of ARC personnel performing air refueling missions and duties in

the future. The dramatic shift of air refueling forces from active duty to the ARC further highlights the need to formulate and publish air refueling operations doctrine. Air refueling doctrine will provide a common guide for active duty and ARC air refueling forces.

The organizational restructuring of the Air Force and cuts in military spending have reshaped the utilization of tanker forces and impact the formulation of air refueling operations doctrine. These factors not only affect the organization and utilization of air refueling forces but have thrust tankers into joint and multinational air refueling operations, the focus of the following section.

Joint and Multinational Air Refueling Operations

Theater commanders are responsible for interservice and, often, multinational operations and must understand how air refueling contributes to achieving strategic and operational objectives. During Operations DESERT SHIELD/STORM, for example, air refueling played an important role in supporting Army rapid deployment operations. By providing air refueling support to airlift forces, the Army was able to quickly and decisively deploy quick-reaction forces and equipment into the Persian Gulf region to stabilize the situation and obviate actual hostilities. In addition, Air Force tankers refueled Navy fighters within the Persian Gulf theater of operations and supported multinational coalition air forces.

Air refueling is being used by air forces in approximately 19 countries and others have plans to acquire the necessary equipment for its use. Some air forces, particularly

those associated with treaty organizations, regularly practice in-flight refueling techniques with US Air Force tankers (Byrd, 1994:194). Highlighting the importance of multinational operations, General Robert W. RisCassi, US Army, reminds us that "almost every time military forces have deployed from the United States it has been as a member of–most often to lead–coalition operations" (Joint Pub 3-0, 1995:VI-1).

Air refueling operations doctrine will support the 1986 Goldwater-Nichols DoD Reorganization Act requiring the military to emphasize joint and combined (multinational) operations and will help guide military planners and commanders in the joint and multinational warfighting arena. As stated in Joint Pub 1, *Joint Warfare of the Armed Forces of the United States*, "the nature of warfare in the modern era is synonymous with joint warfare" (Joint Pub 1, 1995:v). Increasing Air Force joint air refueling support of Naval fighters allows the Department of Defense savings through reduced need for carrier-based Navy tankers while increasing the combat power of carrier task forces.

Another facet of joint operations is Special Operations. Special Operations missions are inherently joint in nature which may include air refueling operations with Navy and Marine combat air forces. According to Air Force Doctrine Document 35, *Special Operations*:

> In philosophy, design, force structure, and employment, special operations are joint in nature. The application of special operations forces usually involves resources well beyond those of a single Service. Air Force special operations forces routinely join with Army special operations aviation, and frequently assume Joint Special Operations Air Component Commander (JSOACC) responsibilities. Support like air refueling may be

essential to ensure successful mission execution. (AFDD 35, 1995:2.4.10 – 2.5.4)

Changing world events have contributed to the restructuring of the United States Air Force, emphasizing joint and multinational operations. These factors contribute to expanding tanker missions, the focus of the following section.

Expanding Tanker Missions

Throughout their history, air refueling tankers have played an important and sometimes central role in the projection of airpower. During Operation Eldorado Canyon, the United States' bombing raid on Libya, air refueling was essential to the successful accomplishment of the mission. Without air refueling, bombers could not reach their targets and return to friendly territory. Air refueling forces allowed bomber aircraft to circumnavigate countries that would not permit US air forces to fly over their land (Moncrief, 1996).

During peacetime and war tankers give the United States Air Force the capability to deploy air assets (fighters, bombers, and cargo aircraft) to regional theaters around the world. Within a regional theater of operations air refueling projects combat airpower deep into enemy territory in support of combat and combat support aircraft. The focus of this section is on tanker forces' expanding strategic and theater missions; however, one's understanding of how tanker missions have expanded is founded in first understanding basic Air Force roles and missions and which roles and missions tanker forces are capable of performing. The following section discusses aerospace roles and missions per Air Force Manual 1-1, Volumes I and II, *Basic Aerospace Doctrine of the United States Air*

Force, and the tankers' ability to accomplish at least three of these missions. Understanding the role and missions of tanker forces and how they support national military strategy is an important step to developing air refueling operations doctrine.

Aerospace Roles and Missions. Air Force Manual 1-1, Volume I, *Basic Aerospace Doctrine of the United States Air Force*, defines aerospace roles and missions. Aerospace forces perform four basic roles in support of national military strategy: aerospace control, force application, force enhancement, and force support (USAFEP 50-38, 1994:B-2). Roles define the broad purposes or functions of aerospace forces. Missions define specific tasks. Figure 9 lists aerospace roles and typical missions associated with those roles.

ROLES	TYPICAL MISSIONS
Aerospace Control (control the combat environment)	Counterair Counterspace
Force Application (apply combat power)	Strategic Attack Air Interdiction Close Air Support
Force Enhancement (multiply combat effectiveness)	**Airlift** **Air refueling** Spacelift Electronic Combat Surveillance and Reconnaissance **Special Operations**
Force Support (sustain forces)	Base Operability and Defense Logistics Combat Support On-Orbit Support

Figure 9. Air Force Roles and Missions (AFM 1-1, Vol. I, 1992:7)

A mission designed to enhance the mobility, lethality, survivability, or accuracy of land, sea, or aerospace forces fulfills the force enhancement role (AFM 1-1, Vol. I,

1992:106). Force-enhancement roles and missions, as stated in AFM 1-1, are defined as follows: "Force enhancement increases the ability of aerospace and surface forces to perform their missions. Air refueling increases the capability of aircraft by extending their range, payload, and endurance" (AFM 1-1, Vol. I, 1992:107).

Air Refueling, Airlift, and Special Operations Missions. Many aerospace forces can perform multiple missions. United States Air Force tanker aircraft are capable of performing at least three primary force-enhancement missions—air refueling, airlift, and special operations air refueling. AMC has designated the KC-135's primary mission as air refueling and has designated the KC-10 as a dual-mission air refueler and airlifter. In addition, KC-135 forces provide air refueling support to special operations missions. We'll take a closer look at each of these missions by reviewing strategic and theater air refueling missions, special operations air refueling missions, and airlift missions.

Strategic Air Refueling Mission. Strategic air refueling, sometimes referred to as intertheater air refueling or global air refueling, supports the long-range movement of airlift, combat, and combat support air forces between theaters. Strategic air refueling supports long-range conventional attack missions and also provide air refueling support for the rapid and flexible "air bridge" deployment of United States air forces. This force-projection capability enhances airpower by decreasing reliance on forward staging bases and host nation support while accelerating the deployment of United States air forces to the theater of operations. Additionally, air refueling increases payload capability for long-range missions by minimizing cargo/fuel load trade-offs (AMMP, 1996:1-13).

Tankers also provide strategic air refueling support for bomber aircraft under the United States nuclear-deterrent Single Integrated Operational Plan (SIOP). SIOP-committed tankers also air refuel USSTRATCOM command and control aircraft (AMMP, 1996:1-13). Air Force Doctrine Document 23 (AFDD 23), *Nuclear Operations*, states:

> Strategic deterrence is, and has been, a key foundation of United States National Military Strategy. United States nuclear forces have been designed, organized, trained, and equipped according to the premise that the mere possession of nuclear weapons is insufficient. Potential adversaries must perceive that, even in the worst-case situation, United States nuclear forces will not only survive, but also penetrate enemy defenses to retaliate. The Air Force organizes, trains, equips, and provides forces for nuclear air and missile warfare in support of this premise. Nuclear forces are those systems capable of delivering nuclear weapons and the forces that support those systems. Aircraft provide stability and flexibility. They can be launched on warning of an attack and recalled if necessary. Air refueling assets extend the range of aircraft and increase the inherent flexibility of nuclear forces. (AFDD 23, 1994:1.1 – 3.5.6.1)

Describing the strategic contribution of airlift and air refueling and the core capabilities the Air Force provides the nation in the post-cold war era, Air Force Chief of Staff General Ronald R. Fogleman said "our airlifters and tankers create air bridges to deploy combat forces from the continental United States and forward bases to the crisis flash point" (Baldwin, 1996:1). "Flying from the United States," said General Fogleman, "Air Force bombers can launch attacks that stop an aggressor in his tracks—then conduct sustained combat operations from theater bases. Fighters deploy to the crisis and fight on arrival, securing control of the air before launching devastating attacks on vital enemy centers" (Baldwin, 1996:1). In order to accomplish these *Global Reach–Global Power* missions, cargo, bomber, and fighter aircraft require air refueling support from tankers to

get to the fight. Once they reach the theater of operations, air refueling plays an essential role during the employment of tactical airpower, extending the combat reach and staying power of United States air forces.

Theater Air Refueling Mission. Theater air refueling forces provide common-user air refueling of combat and combat support air forces within a warfighting commander-in-chief's (CINC) area of responsibility (AOR) and occasionally outside the AOR. The theater air refueling mission generally requires tanker aircraft that are capable of operating under a wide range of tactical conditions including austere airfield operations. Combat and combat support air forces rely heavily on air refueling during employment and execution of a theater air campaign. Air refueling is a force enabler and multiplier, making certain missions possible and expanding both the reach and power of combat forces. It is this emphasis on a conventional response to regional threats which generates the majority of today's air refueling requirements (AMMP, 1996:1-13). Within an operational theater air refueling tankers support a wide variety of combat and combat support air forces. Among the many aircraft that tankers support, the most common include fighters, bombers, attack, airborne warning and control system (AWACS), electronic warfare, and airborne battlefield command and control center (ABCCC) aircraft. Highlighting the contribution of air refueling to close air support missions, Air Force Manual 1-1, *Basic Aerospace Doctrine of the United States Air Force*, Volume II states: "Effective close air support requires flexible and responsive control.

Responsiveness also requires nearby bases or air refueling to permit airborne alert" (AFM 1-1, Vol. II, 1992:6.2).

Special Operations Air Refueling Mission. The Air Force is custodian to specialized units designed to provide Special Operations Forces (SOF) access to denied territory. The mission of these units is to conduct infiltration, resupply, exfiltration, and airlift of SOF assets under clandestine or covert conditions. Special Operations employment is the use of special airpower operations to conduct the following joint special operations missions: unconventional warfare, direct action, special reconnaissance, counterterrorism, foreign internal defense, psychological operations, and counterproliferation. Specialized air refueling forces are designated to provide air refueling support to airlift, combat, and combat support air forces in support of SOF elements. The air refueling of special operations aircraft is distinguished by the customer's unique requirements. Successful mission completion requires special equipment, specialized crew training, and modified operational procedures. United States Southern Command (USSOCOM) requires that aircrews be special operations air refueling qualified, able to work within a nonstandard command and control network, use Special Operations Forces peculiar mission planning systems, operate under communications-out conditions, and use non-standard night operations (AMMP, 1996:1-13). Air Force Doctrine Document 35 (AFDD 35), *Special Operations*, states:

> Air Force Special Operations Forces is an umbrella term for those active and reserve component Air Force personnel, designated by the Secretary of Defense, that are specifically organized, trained, and equipped to conduct and support special operations. They are specially trained in infiltration, exfiltration, resupply, air refueling, close air support, and

> psychological operations. To ensure special operations forces can maintain a long-range operating capability, USAF maintains tanker crews familiar with air refueling requirements of fixed-wing special operations aircraft. (AFDD 35, 1995:1.1-2.7.2)

In general, Air Force special operations airlift, combat, and combat support air forces may require air refueling support in the form of low-altitude, night, communications-out, all-weather air refueling capability.

Airlift Mission. Although this paper is not about airlift, it is important for one to understand that United States Air Force tanker forces are not utilized solely as aerial refuelers but are used as airlifters as well. In addition to their peacetime and wartime mission as force-enhancement aerial refuelers, tankers support the movement of cargo and passengers during peacetime and are planned to be utilized as airlifters during wartime deployments. Air Mobility Command's 1996 *Air Mobility Master Plan* lists both KC-135s and KC-10s as airlift aircraft as well as air refueling aircraft. Further, Air Mobility Command has allocated a portion of KC-135s and KC-10s to perform strategic airlift missions during a major regional contingency (AMMP, 1996:1-9, 1-11). It is important for military planners and combatant commanders to understand that when tanker assets are used as strategic airlifters they are not available for theater air refueling operations, possibly having a negative impact on the theater air campaign.

The most common airlift mission for tankers is the "channel mission"—recurring, routine strategic airlift missions along established routes (HQ AMC/XP, 1996). Operating as an airlifter, the KC-135 is capable of transporting relatively small cargo and passenger loads. The KC-10 is the preferred tanker choice for strategic airlift and

outperforms the KC-135 due to its significantly greater weight and volume transportation capacity and its capability to receive fuel in flight. The KC-10 is capable of carrying up to 79 passengers, or a maximum cargo weight of 170,000 pounds while the KC-135 only carries up to 58 passengers, or approximately 35,000 pounds of cargo (AMMP, 1996:5-40). In addition, the KC-10's design allows it to perform a unique dual-mission in support of deploying fighter units (composite force deployment). The KC-10's large fuel-carrying ability coupled with its large cargo-carrying ability gives fighter units the luxury of rapidly moving essential elements of their unit during deployment and redeployment, allowing them to set up a functional operations center during the first days of a conflict. With several KC-10s, deploying fighter units are able to load critical equipment and personnel aboard the KC-10, deploy and air refuel to a theater of operation with the KC-10, and arrive on station with their equipment and personnel.

Understanding how tanker assets are utilized and are planned to be utilized is an important step toward developing air refueling operations doctrine. By properly allocating air refueling forces tankers can be used to help achieve operational objectives, which in turn support broader strategic objectives. Of course, any discussion of operational doctrine would be incomplete without addressing command and control issues, the subject of the next section.

Command and Control

When discussing doctrine it is important to outline and clarify command and control relationships. Air refueling forces have distinct command and control

arrangements based largely on four functional classifications—strategic, theater, organic, and special operations air refueling. These classifications depend on the mission the air refueling asset is performing and not on the type of airframe itself. Prior to discussing each functional classification, I will present a few command and control terms.

Combatant Command (COCOM) – Nontransferable command authority established by title 10, ("Armed Forces") United States Code, Section 164, exercised only by commanders of unified or specified combatant commands unless otherwise directed by the President or the Secretary of Defense. Combatant command cannot be delegated and is the authority of a combatant commander to perform those functions of command over assigned forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction over all aspects of military operations, joint training, and logistics necessary to accomplish the missions assigned to the command. Combatant command should be exercised through the commanders of subordinate organizations. Normally, this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Combatant command provides full authority to organize and employ commands and forces as the combatant commander considers necessary to accomplish assigned missions. Operational control is inherent in combatant command (JP 1-02, 1994:78).

Operational Control (OPCON) – Operational control is the transferable command authority that may be exercised by commanders at any echelon at or below the level of

combatant command. Operational control is inherent in combatant command (command authority). Operational control may be delegated and is the authority to perform those functions of command over subordinate organizations involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control includes authoritative direction over all aspects of military operations and joint training necessary to accomplish missions assigned to the command. Operational control should be exercised through the commanders of subordinate organizations. Normally this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Operational control normally provides full authority to organize commands and forces and to employ those forces as the commander in operational control considers necessary to accomplish assigned missions. Operational control does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training (JP 1-02, 1994:301).

Tactical Control (TACON) – TACON is the command authority over assigned or attached forces or commands, or military capability or forces made available for tasking, that is limited to the detailed and usually local direction and control of movements or maneuvers necessary to accomplish assigned missions or tasks. TACON provides sufficient authority for controlling and directing the application of force or tactical use of combat support assets. Tactical control is inherent in operational control. Tactical control may be delegated to and exercised at any level at or below the level of combatant

command. TACON does not provide organizational authority or authoritative direction for administrative and logistic support (JP 0-2, 1994:410).

Supported/Supporting Command – Support is a command authority. A support relationship is established by a superior commander between subordinate commanders when one organization should aid, protect, complement, or sustain another force. Support may be exercised by commanders at any echelon at or below the level of combatant command. This includes the NCA designating a support relationship between combatant commanders as well as within a combatant command. The designation of supporting relationships is important as it conveys priorities to commanders and staffs who are planning or executing joint operations. The establishing authority is responsible for ensuring that both the supported and supporting commander understand the degree of authority the supported commander is granted (JP 0-2, 1994:403).

Having reviewed a few important command and control terms I will now discuss strategic, theater, organic, and special operations air refueling classifications and the command and control relationships that govern air refueling forces.

Strategic air refueling command and control is designed to support the long-range movement of airlift, combat, and combat support air forces between theaters. The available air refueling support that tankers provide is apportioned among the Services and joint forces on a common-user basis in accordance with guidance from the NCA. The Secretary of Defense, through the Chairman of the Joint Chiefs of Staff (CJCS), is the apportioning authority. USCINCTRANS has COCOM of strategic air refueling forces

and executes OPCON through the Commander, Air Mobility Command and Commander, Air Combat Command for strategic air refueling operations (Murin, 1996).

Theater air refueling command and control is designed to support a theater CINC; therefore, theater air refueling assets are normally either assigned or attached to a specific theater CINC as required by the situation. Theater air refueling forces are joint force assets whose useful capacity is apportioned on a common-user basis in accordance with guidance from the appropriate Joint Force Commander (JFC). This apportionment is usually recommended by a Joint Force Air Component Commander (JFACC). The theater CINC will exercise COCOM of assets that are assigned in the Forces For Unified Commands Memo, or OPCON if the theater air refueling forces are attached by the SECDEF (Murin, 1996).

Organic air refueling forces are those assets that are an integral part of a specific Service, Component, or MAJCOM and primarily support the requirements of the organization to which they are assigned. Organic air refueling support is apportioned in accordance with guidance from the commander of that Service, Component, or MAJCOM. Organic air refueling command and control relationships are designed to support a specific MAJCOM commander, theater Service commander, or functional component commander; accordingly, those commanders normally retain OPCON over organic air refueling assets (Murin, 1996).

When employed, Special Operations air refueling forces normally fall under a special operations functional component within a joint operating area. These forces will

not normally be used by a Joint Forces Commander (JFC) as conventional air refueling for common users (Murin, 1996). Special Operations air refueling command and control relationships are designed to support a specific theater commander or functional component commander.

Proposed Air Force Doctrine Document—Air Refueling Operations

Understanding the history and evolution of air refueling, outlining the need to formulate and publish air refueling operations doctrine, understanding the concepts and principles of basic aerospace doctrine, and analyzing the driving forces that shape the utilization of tankers are important steps towards developing and publishing United States Air Force air refueling operations doctrine. Appendix A presents proposed air refueling operations doctrine. It is important to point out that Air Force Doctrine Document 30 (AFDD 30), *Airlift Operations*, was used as a guide to establish the framework for the proposed air refueling doctrine. Previous research conducted on the need for air refueling doctrine concluded that the format of AFDD 30 would serve as a perfect guide to develop air refueling operations doctrine (Monihan, 1996:39). Using AFDD 30 as a template the chapters and subchapters were developed to ensure major doctrinal concepts were addressed. Like air refueling, airlift performs a basic aerospace "force-enhancement" role; therefore, one would expect to find similarities between doctrinal principles. Where similarities exist it is only because the concepts, theories, and principles are in fact similar.

VI. Summary

The United States Air Force, the aerospace arm of the United States' armed forces, has developed basic aerospace doctrine to guide and direct operations in the aerospace medium. The basic objective of aerospace forces is to take decisive action against an adversary's vulnerable strategic centers of gravity. In this manner aerospace forces are inherently more strategic in nature than either land or naval forces. Although aerospace forces perform many crucial "force-enhancement" missions, one is uniquely important to the success of military air operations—air refueling. Air refueling has become indispensable in modern warfare. Air refueling capability ensures that the unique flexibility of airpower (concentration of power quickly at any point on the globe against any facet of an enemy's power) is a reality rather than an abstract concept.

A well-written air refueling doctrine document, designed to educate all airmen on the force-enhancement role and limitations of air refueling, will greatly benefit the United States Armed Forces. Operational air refueling doctrine should be used to guide decisions regarding operational employment of tankers as well as decisions regarding tanker force sizing, future weapons acquisition, and technology integration. Unfortunately, many decisions regarding the employment of tankers are made without understanding the capabilities and limitations of the weapon system.

The Air Force has published doctrine supporting its objectives at the strategic, operational, and tactical levels. Several fundamental and enduring principles in Air Force doctrine provide guidance on Air Force organization and execution of the air war;

however, not all Air Force flying operations are governed by doctrine publications. Strategic and tactical bombing, air-to-air combat, close air support, and airlift doctrine have been developed and refined since their implementation, but air refueling doctrine has yet to be published. Despite the importance of air refueling doctrine to teach and prescribe the best operational use of air refueling, its development has been ad hoc.

The purpose of this research paper was to propose air refueling operations doctrine for the United States Air Force. This proposal was intended to offer a framework of fundamental concepts and doctrinal principles that should be included in Air Force air refueling operations doctrine. In offering air refueling operations doctrine, this paper reviewed the history and evolution of air refueling, outlined the need to formulate and publish air refueling operations doctrine, analyzed fundamental concepts of aerospace doctrine, and addressed important factors shaping the content of air refueling doctrine. The proposed air refueling operations doctrine is presented at Appendix A.

Developing and publishing air refueling operations doctrine is important because commanders and military planners who are not familiar with air refueling operations need a tool to guide their decisions about utilizing air refueling forces. Further, air refueling doctrine provides a formal document to codify lessons learned; hopefully, helping warfighting commanders to avoid repeating mistakes made during previous air refueling operations.

APPENDIX A

PROPOSED AIR FORCE DOCTRINE DOCUMENT AIR REFUELING OPERATIONS

Air Force Air Refueling Operations Doctrine is intended to provide doctrine for air refueling operations and supports basic Air Force aerospace doctrine. This document is consistent with and complements Joint Pub 3-0 *Doctrine for Joint Operations* (1995), Air Force Manual 1-1, Volumes I and II, *Basic Aerospace Doctrine of the United States Air Force* (1992), Air Force Doctrine Document (AFDD) 23 *Nuclear Operations* (1994), and AFDD 35 *Special Operations* (1995). Its purpose is to promulgate theories, concepts, and principles of air refueling operations. As such, it focuses on how air refueling assets can be organized, trained, equipped, and operated to conduct air refueling operations. This document should apply to all active duty, Air Force Reserve, Air National Guard, and civilian Air Force personnel. The doctrine should be authoritative but not directive; commanders are encouraged to exercise judgment in applying doctrine to accomplish their missions.

Tankers are the lifeblood of global reach and global power. Air refueling assumes increasing importance as a force multiplier in a period of smaller forces and declining forward basing. Tankers build air bridges to sustain high rates of airlift to any point on the planet, sometimes flying more sorties than the airlifters. Strike packages rely on tankers to extend range and payload, and guarantee air forces the global reach to deploy rapidly and to employ effectively. Land-based tanker forces are indispensable to support a range of theater air operations. In Southwest Asia, joint United States and Coalition forces depended on USAF tankers for operations beyond the littoral.

Global Reach–Global Power
Department of the Air Force "White Paper" (1990)

Chapter 1

INTRODUCTION

1.1. General. United States (US) national security strategy often relies upon the force-enhancement role that air refueling provides to military air forces. Air refueling supports the national military strategy across the spectrum of conflict, from peacetime operations for American global interests to major regional contingencies and nuclear deterrence. It is the synergy of combining airlift and air refueling capabilities which provides the speed and flexibility in deploying, employing, and sustaining our combat forces. Further, it is the synergy of combining combat air forces and air refueling capabilities which provides the flexibility, versatility, and depth in employing combat airpower. With America's post-Cold War force primarily CONUS based, rapid power projection is essential to establishing and enforcing a secure United States or multinational presence. Airlift will deliver the bulk of the initial firepower or the time-critical supplies for peacekeeping or humanitarian relief. Air refueling enhances airlift's capability to rapidly reach any likely trouble spot around the world with less reliance on forward staging bases. The ability to project substantial combat and combat support air forces to a regional contingency by means of air refueling lies at the heart of a credible conventional deterrent posture. Air refueling forces contribute to US national security by enhancing the ability to quickly apply global power to various crisis situations worldwide by projecting combat air forces. The power-projection capability that air refueling supplies to airlift missions is vital since it provides the flexibility and versatility to get rapid reaction forces to the point of a crisis with minimum delay. Accordingly, air refueling is viewed as a foundation of US national security at the strategic level and as a crucial capability for combatant commanders at the operational level within a regional theater. Air refueling also supports overall US national security policy by projecting American power and influence in a wide range of non-lethal applications of airpower. For example, air refueling's ability to enhance airlift forces in a foreign humanitarian assistance role has greatly increased the prestige and political standing of the United States throughout the world. Air refueling is not only a vital component of US defense policy, but a critical asset in executing overall national policy and objectives.

1.2. Definition. Air refueling is the in-flight transfer of fuel between tanker and receiver aircraft. It is a key mission area of the United States Air Force that, along with airlift, fulfills the Air Force contribution to the joint mobility role. In addition, air refueling fulfills part of the Air Force contribution to the joint Single Integrated Operational Plan and joint combat and combat support air force employment role. The Air Force provides and manages all common-user air refueling for the Department of Defense. In addition to common-user air refueling, the USAF also operates task-specialized air refueling aircraft primarily designated to support a specific user or set of users. Air Force air refueling forces consist primarily of fixed-wing aircraft and assets required to plan, execute, and control air refueling operations.

Chapter 2

AIR REFUELING BASICS

2.1. General. This chapter presents the two overall objectives of air refueling and then outlines and discusses the three functions under which all air refueling actions may be grouped. Air refueling, by its very nature, has a wide variety of applications and specific tasks that can have overlapping goals and command structures. This discussion is intended to highlight the common doctrinal basis of air refueling operations regardless of the organizational or command structure that it operates under.

2.2. Air Refueling Objectives. The primary objectives of air refueling are twofold. The first is to enable and enhance the global reach and global power of US military forces by supporting and executing the plans and operations of combatant commands and Services. Air refueling's second objective is to support US national security policy by conducting operations in support of national military strategy. It can accomplish this through support of combat and combat support air operations or can directly carry out national policy objectives in a wide range of non-lethal applications of airpower, across the globe, as directed by the National Command Authority (NCA). The recent proliferation of regional power competitions around the world has greatly increased the importance air refueling plays in executing national security policy and maintaining stability. Together, these two objectives of air refueling are key in the projection of US national power across the full spectrum of military and political actions.

2.3. Air Refueling Functions. Air refueling performs three basic functions in support of air refueling objectives. First, air refueling provides rapid and flexible force mobility options that allow military forces to respond to and operate in a wider variety of circumstances and time frames. Air refueling provides for the rapid aerial deployment of entire combat units and enables "air bridges" between the CONUS and warfighting theaters. Second, air refueling provides the unique ability to project and sustain airpower. This provides combatant commanders an added dimension of applying combat air power. Third, air refueling forces are key to the execution of a wide range of non-lethal military operations such as foreign humanitarian assistance, giving US forces a global presence. Figure 1 depicts air refueling objectives and functions.

AIR REFUELING OBJECTIVES

FORCE ENABLER ● FORCE ENHANCEMENT ● SUPPORT NATIONAL POLICY

AIR REFUELING FUNCTIONS

POWER PROJECTION	FORCE MOBILITY OPTIONS	NON-LETHAL APPLICATIONS
• PROJECT STRATEGIC ATTACK THROUGH SINGLE INTEGRATED OPERATIONAL PLAN AIR REFUELING SUPPORT • PROJECT AND SUSTAIN COMBAT AIRPOWER DURING EMPLOYMENT • PROJECT SPECIAL OPERATIONS FORCES BY PROVIDING AIR REFUELING SUPPORT TO AIR ASSETS	• ENHANCE RAPID AERIAL DEPLOYMENT OF ENTIRE COMBAT UNITS • PROVIDE AIR REFUELING SUPPORT FOR "AIR BRIDGES" BETWEEN THEATERS	• PROVIDE AIR REFUELING SUPPORT DURING HUMANITARIAN ASSISTANCE OPERATIONS • INFLUENCE INTERNATIONAL STABILITY VIA AIR REFUELING OF AIRLIFT FORCES • ASSERT GLOBAL PRESENCE THROUGH STRATEGIC AIR REFUELING OF DEPLOYING AIRLIFT, COMBAT, AND COMBAT SUPPORT AIR FORCES

Figure 1. Air Refueling Objectives and Functions

2.3.1. Power Projection. Air refueling projects airpower and increases the ability of aircraft by extending their range, payload, and endurance. Air refueling can project power with limited regard to geographic obstacles and forward operating bases. This enhances the ability of airlift, combat, and combat support air forces to effectively respond to any worldwide situation by increasing their responsiveness and flexibility. This global-reach, power-projection capability applies the principle of economy of force by providing for the more complete and fullest use of available airlift and combat air forces. Over the years air refueling has on many occasions enabled the initial and rapid projection of combat air forces into a theater and been a critical element of the Joint Force Commander's (JFC) scheme of maneuver within the area of operations. The Gulf War was such an occasion. Adding to the options available to a JFC, specialized air refueling assets are designated to provide special operations air refueling support to conduct clandestine and covert missions.

2.3.2. Increase Force Mobility Options. Air refueling increases force mobility options by extending range, payload, and endurance of air assets, giving US air forces true global-reach capability. Air refueling provides US military air forces the latitude to operate in a broader range of situations. Air refueling can project power with limited regard to

geographic obstacles and forward operating bases. This elevates the ability of airlift and combat air forces to effectively respond to any situation by increasing their range, responsiveness, and flexibility. This global-reach capability applies the principle of maneuver by placing the enemy in a position of disadvantage through the flexible application of airpower. In a crisis or contingency situation, the rapid deployment of airlift, combat, and combat support air forces can deter a violent situation or limit hostilities on a scale that would have required a much larger force later on. An example of this occurred in October of 1994 when Iraqi forces made threatening force deployments toward the Kuwaiti border. The US responded with Operation Vigilant Warrior. During this operation air refueling made possible the rapid projection of large numbers of Air Force tactical and airlift aircraft carrying combat troops and their required support to Kuwait, effectively preventing any aggressive action by Iraq. Redeployment of US air forces with the support of air refueling assists in the expeditious reconstitution of forces and increases readiness.

2.3.3. Non-Lethal Applications of Airpower. An important mission of air refueling forces is to provide the means for executing US national security policy in military operations where the primary goal is not application of combat force. In this type of operation, air refueling often functions as an important element to achieving operational success. Some examples of this include air refueling support of strategic airlift aircraft during humanitarian aid to Somalia in 1992, emergency relief response to Rwanda in 1994, and the intervention to restore democracy and political stability in Haiti in 1994. As the world situation becomes more competitive among regional powers, air refueling will continue to play an increasing role in maintaining stability and exerting US influence. The presence of US air refueling aircraft within a foreign country sends a clear message that a certain area or region is important to American interests and demonstrates the will and ability to act upon those interests. In this manner air refueling assets provide a level of presence and engagement of US forces in an area where it may not be politically viable nor wise to exhibit more threatening combat forces. Around the globe, in nearly every country in the world, the symbol of American power and determination has been represented by the US flag on air refueling aircraft responding to an international need or crisis. The statement that these operations make about US capability and purposefulness is equally clear to both friends as well as potential enemies. Air refueling's ability to build American prestige and to generate international goodwill should not be underestimated in executing US national policy.

2.4. Mobility Framework. Air refueling forms one part of the long-range force-projection equation. The other parts are (1) forward deployment of forces, (2) pre-positioning of equipment, (3) airlift, and (4) sealift. Air refueling platforms play a vital part in the force-projection equation. They fulfill mobility requirements by deploying shorter range combat and combat support air forces into theaters of operation. Additionally, air refueling assets increase the capabilities of airlift assets by extending their effective range and payload, reducing en route transit time, and easing the workload

on intermediate staging bases. In regions where the threat is well established or substantial, forward-deployed forces may be used for a portion of the combat force requirement. This method was used extensively in Europe, and to a lesser extent, on the Korean peninsula. Forward deployment of forces is an expensive option and one that may no longer be politically feasible in many areas. The option of pre-positioning equipment in regional theaters only requires personnel be transported to locations where their heavy equipment is already in place, either in land storage or on ships. This option is used in Southwest Asia to fulfill United States' commitment to the region. Both options presuppose that the crisis area is identified well before a response is required. Airlift provides the capability to deploy, sustain, and reinforce combat forces anywhere on the globe. However, it can be limited by total numbers, weight, and volume of heavy combat units as well as the distance to be traveled. Due to these limitations, sealift plays a major role in the deployment and sustainment of heavy forces. Efficient, fast sealift vessels designed for military mobility requirements are critical in filling the enormous lift demands of any large-scale deployment. During the Gulf War the great majority of heavy combat units were moved by sealift. Accordingly, the overall mobility picture should be formulated considering all parts of the power projection framework including, air refueling, forward-deployed forces, prepositioned equipment, airlift, and sealift assets.

2.5. Combat Support Framework. Air refueling forms one part of the intratheater force-enhancement equation. Combat support air refueling provides common-user air refueling of combat and combat support air forces within a commander-in-chief's (CINC) area of responsibility (AOR) and occasionally outside the AOR. The theater air refueling mission generally requires aircraft capable of operating under a wide range of tactical conditions including austere airfield operations. Combat and combat support air forces rely heavily on air refueling during execution of combat operations. Air refueling is a force multiplier, expanding both the reach and power of combat forces.

2.6. Air Refueling Planning Focus. Air refueling should be incorporated in deliberate as well as crisis action planning to maximize its global power-enhancing effects and ensure operational success. Normally, during the first hours of a contingency plan execution or crisis reaction, it is imperative to get combat forces in place in order to consolidate positions and to protect American interests and lives. Air refueling enhances the United States' ability to rapidly project forces worldwide, making it a prime focus of initial crisis action as well as contingency planning. Often, air refueling's first response is to deploy Air Force tactical fighter units to the theater to provide a credible defensive deterrent. During Desert Shield, air refueling's initial task was to deploy F-15 units to the Saudi Arabian peninsula to maintain air superiority over the critical and vulnerable force buildup.

2.6.1. Due to its role in rapid power projection of American air power, air refueling's most critical global-reach effect is felt in the first few days of an operation. Air refueling is particularly indispensable during the initial days of a crisis reaction since its role as a

global power enhancer in many cases cannot be replaced or even supplemented by any other means. As part of a combatant commander's theater air campaign, air refueling helps sustain combat air power and its power-enhancing effect is felt throughout the duration of the air campaign

2.6.2. Planners must determine how to properly allocate limited air refueling assets, determine which aircraft receive priority air refueling, and to what level of risk commanders are willing to expose the air refueling force. Additionally, deployed forces may have to be self-sufficient during the early stages of an operation since the logistics system may not be in place. Initial air refueling forces should deploy with adequate accompanying supplies to maintain operations until the forward location is capable of supporting operations and a resupply pipeline is established. As the contingency matures, air refueling continues its support of military operations as an important element of the overall mobility system and sustainment of theater air power. The operation, contingency, or campaign objectives, and the nature of the enemy threat should be the paramount considerations in planning the employment of air refueling forces.

2.7. Air Refueling Intelligence Support. A responsive intelligence capability is essential for planning and executing both strategic and theater air refueling operations across the range of military operations. Data bases should be maintained on air refueling associated threats. Another data base that is useful for air refueling operations is one that contains the air refueling-associated support capability available in the theater. This data base should answer questions such as fuel availability, maintenance support, spare parts availability, crew rest facilities, and other infrastructure information that may be necessary for an air refueling unit to establish operations. Additionally, intelligence may be able to estimate, from a political analysis of a nation, the level of host-nation support that the country might be expected to offer to United States forces. During contingencies and crisis responses, threat status should be provided to crews prior to and during air refueling missions, if possible. Air refueling intelligence elements rely on national, joint, and service intelligence components accurate and timely information. Air refueling units in turn should plan for and clearly state their requirements to higher headquarters to ensure responsive and appropriate intelligence is received to support the air refueling mission.

Chapter 3

AIR REFUELING CATEGORIES

3.1. General. This chapter examines the organizational components, functional classifications, rendezvous methods, and types of in-flight refueling equipment associated with air refueling operations. In this manner the air refueling force can be analyzed with regard to its source of assets, basic air refueling operations, types of air refueling rendezvous, and types of air refueling equipment used during refueling operations.

3.2. Air Refueling Components. Air Force air refueling forces are comprised of three organizational components: active, reserve, and National Guard. All of these components contain characteristic operational and support capabilities. A thorough understanding of the advantages and disadvantages of each component is necessary to use these limited air refueling assets wisely.

3.2.1. Active Duty Component. Active duty component air refueling forces are attached to various Air Force Major Commands (MAJCOM). The main contribution of these active duty forces is to perform the core military air refueling missions that require specialized training, equipment, or aircraft physically capable of accommodating the dimensions of military equipment and vehicles. Commanders have full access to their active duty component assets at all times and air refueling forces are routinely ready for rapid deployment of forces worldwide. A drawback of active duty forces is the relatively higher expense of maintaining a pool of available air refueling capacity on a full-time basis as compared to the Air Reserve and Air National Guard components which function on a part-time basis until needed.

3.2.2. Air Reserve Component (ARC). ARC air refueling forces are established in both the Air Force Reserve and the Air National Guard. Mobilized ARC air refueling forces normally fall under the OPCON of Air Mobility Command (AMC) or Air Combat Command (ACC), unless they are temporarily transferred through a change of operational control (CHOP) to a theater CINC. ARC air refueling forces execute air refueling missions in support of US requirements on a daily basis. Additionally, a main contribution of the ARC air refueling forces is to maintain readiness to augment active duty forces as required. This approach provides an increased war reserve capacity of air refueling at a lower per-unit cost relative to the active component. ARC air refueling personnel usually have a high experience level and generally maintain the same capability to perform the core military missions as the active forces. Access to ARC forces is provided through a system of volunteerism or through formal activation of units; therefore, a portion of ARC forces are mission ready and available at all times under volunteerism. However, a protracted deployment, as might be expected during a major regional contingency (MRC), will usually require activation of ARC units. A main consideration of this component is the additional response time and delays inherent in the

political decisions and administrative actions required for the activation of ARC units during a large-scale or lengthy deployment.

3.3. **Air Refueling Classifications.** There are four functional classifications of air refueling—strategic, theater, organic, and special operations air refueling. These classifications depend on the mission the air refueling asset is performing and not on the type of airframe itself.

3.3.1. Strategic Air refueling. Strategic air refueling, sometimes referred to as intertheater air refueling or global air refueling, supports the long-range movement of airlift and combat air forces between theaters. This includes air refueling support for the United States Single Integrated Operational Plan (SIOP). Strategic air refueling supports the "airbridge" that links overseas theaters to the continental United States (CONUS). The available air refueling support that these forces provide is apportioned among the Services and joint forces on a common-user basis in accordance with guidance from the NCA. USCINCTRANS has combatant command (COCOM) of strategic air refueling forces and executes OPCON through the Commander, Air Mobility Command and Commander, Air Combat Command for strategic air refueling operations. The Secretary of Defense, through the Chairman of the Joint Chiefs of Staff (CJCS), is the apportioning authority.

3.3.2. Theater Air Refueling. Theater air refueling forces provide common-user air refueling of combat and combat support air forces within a CINC's area of responsibility (AOR) and occasionally outside the AOR. The theater air refueling mission generally requires aircraft capable of operating under a wide range of tactical conditions including austere airfield operations. Theater air refueling assets are normally either assigned or attached to a specific theater CINC as required by the situation. Theater air refueling forces are joint-force assets whose useful capacity is apportioned on a common-user basis in accordance with guidance from the appropriate Joint Force Commander (JFC). This apportionment is usually recommended by a Joint Force Air Component Commander (JFACC). The theater CINC will exercise COCOM of assets that are assigned in the Forces For Unified Commands Memo, or OPCON if the theater air refueling forces are attached by the SECDEF.

3.3.3. Organic Air Refueling. Organic air refueling forces are those assets that are an integral part of a specific Service, Component, or MAJCOM and primarily support the requirements of the organization to which they are assigned. Their air refueling support is apportioned in accordance with guidance from the commander of that Service, Component, or MAJCOM. The specific MAJCOM commander, theater Service commander, or functional component commander, normally retains OPCON over organic air refueling assets. An example of organic air refueling forces is the Marine KC-130 tanker fleet.

3.3.4.1. Special Operations Air Refueling. The Air Force is custodian to specialized units designed to provide Special Operations Forces (SOF) access to denied territory. The mission of these units is to conduct infiltration, resupply, exfiltration, and airlift of SOF assets under clandestine or covert conditions. Specialized air refueling forces are designated to provide air refueling support to airlift and combat air forces in support of SOF elements. When employed, these air refueling forces normally fall under a special operations functional component within a joint operating area. These forces will not normally be used by a JFC as conventional air refueling for common users.

3.4. Air Refueling Rendezvous Methods. Another category defining air refueling is the type of rendezvous method used to accomplish its air refueling task. The rendezvous method determines the procedures employed to enable the receiver(s) to reach the precontact position behind the assigned tanker(s) by electronic, radio, and/or visual means. The basic types of rendezvous procedures are point parallel and en route. All other rendezvous procedures are modifications of the basic types. Each method has a number of procedural applications. The method chosen is based upon a variety of planning factors; these include timing requirements, type of receiver, number of receivers, receiver aircraft's post air refueling routing, operational objective, user requirements, and enemy threat systems. During all air refueling rendezvous altitude separation (normally 1,000) is imperative to safe air refueling operations.

3.4.1. Point Parallel Rendezvous. Accomplished with the tanker(s) maintaining an appropriate offset and altitude while flying towards the receiver(s), the receiver(s) flying a straight track towards the tanker(s), and the tanker(s) turning in front of the receiver(s) at a computed turn range.

3.4.2. En route Rendezvous. Procedure used when joinup between the tanker(s) and receiver(s) is accomplished en route to the refueling area. An en route rendezvous is accomplished by having the tanker(s) and receiver(s) fly individual flight plans to a common rendezvous point, accomplish a joinup, and continue en route as a formation to the air refueling control point to conduct air refueling operations.

3.5 Air Refueling Equipment. The final category defining air refueling is the type of air refueling equipment used during refueling operations. Air refueling tankers use two basic types of equipment to offload fuel to receivers: boom and hose/drogue. Future acquisition decisions should consider the need for both boom and hose/drogue-type equipment to increase the versatility of tanker forces across Service components and in support of multinational air refueling operations.

Chapter 4

ORGANIZING AND EQUIPPING AIR REFUELING FORCES

4.1. General. Air Force air refueling forces are organized, trained, and equipped to perform the task of providing the best possible air refueling support to Air Force and joint forces across the entire range of military operations. The useful capacity of air refueling forces should be apportioned among appropriate users in ways that make sense within the context of air refueling requirements. Air refueling command relationships should assign operational authority to air component commanders, while available air refueling capacity is apportioned at the appropriate level of Service or joint-level systems according to guidance set by the JFC.

4.2. Air Refueling Requirements. Estimating total air refueling requirements is challenging because of the many factors contributing to the overall division of requirements. Foremost among these factors are national security policy goals and objectives, regional stability factors, international political factors, as well as size and sophistication of the likely threats. The distance to likely crisis locations, availability of en route air bases, and infrastructure in the theater will also affect the optimum division and type of air refueling tankers. Finally, budget constraints place upper limits on air refueling forces. Since these factors are difficult to assess, efforts to quantify air refueling requirements will at best provide realistic estimates rather than exact predictions of total requirements. Regardless, the requirements should be carefully evaluated by comparing the expected contingency response commitments with available air refueling capability. In practice, air refueling planners have based operational and force-structure estimates and plans on a reasonable maximum requirement and then adjusted for budgetary constraints. Air refueling apportionment, because of its finite nature, should be coordinated to achieve the proper concentration of tanker assets necessary at a given time and location. Therefore, any discussion of air refueling requirements in support of strategic and theater air forces should address the timed-phase deployment and priority of military forces. Assuming the availability of air refueling assets will be less than required, planners should carefully devise the number and mix of air refueling forces which provides the optimum level of air refueling support for US military air forces. Air refueling apportioners and operators should use these resulting air refueling forces as efficiently as possible in the execution of mission taskings.

4.3. Air Refueling Organization. Air Force air refueling forces are organized along functional lines. Strategic and theater air refueling assets operate with distinct and separate command relationships. Forces intended for strategic use come under the combatant command (COCOM) of USCINCTRANS. On the other hand, forces earmarked to function in the theater air refueling role change operational control (CHOP) from USCINCTRANS and are organized under the COCOM of a theater CINC and OPCON of a JFC. As the situation dictates, air refueling forces may be assigned or

attached to a different JFC within a theater CINC's area of responsibility (AOR). Since air refueling is nearly always supporting either a JFC or a specific user, the supported/supporting commander relationship is important in defining authority and responsibilities during air refueling operations. When it is necessary for theater air refueling to augment strategic air refueling assets (or vice versa), then supported/supporting commander relationships dictate the degree of authority.

4.4. Air Refueling Forces Capability. An important facet of air refueling doctrine is that the capabilities designed into air refueling forces should consistently support United States joint military air forces across the range of military operations. When feasible and in the interest of the United States, air refueling capabilities should support allied air forces to enhance multinational operations. Commanders making decisions affecting air refueling capability should carefully consider the advantages of a well-tailored air refueling force. Principal among air refueling advantages are flexibility, versatility, speed, and responsiveness, and reliability. The selection of air refueling airframes, equipment, and modernization programs should focus on air refueling that possesses these advantages regardless of the environment in which forces should operate. For example, future air refueling tankers should be designed and equipped to support both boom and drogue-type refueling on the same mission, making them more flexible and versatile to both joint and multinational operations. The KC-10 has incorporated this design which has proven to be a valuable feature for joint and multinational air refueling operations.

4.4.1. Operating Environment. Military air refueling missions often require operating out of austere forward locations. These austere locations will most likely have minimal support equipment and substandard runways. Military air refueling airframes and equipment should be chosen on the basis of their capability to function in these minimal support environments with large fuel loads. Additionally, US military forces emphasize all-weather, night operations. Air refueling forces should be capable of operating during periods of darkness and under adverse weather conditions. Depending upon the operation, this may require precision navigation equipment as well as night vision capability and associated training. Air refueling assets not designed for versatility and responsiveness under combat conditions have a limited scope of applications when compared to fully capable military air refueling aircraft and as a result may retain far less value as a military asset. The capability level of the air refueling forces should be consistent with the overall national strategy, as well as with the operational doctrine of those air forces that air refueling supports. Therefore, the mix and composition of air refueling airframes and equipment should be capable of operating under the widest possible set of circumstances. These capabilities are acquired through a balanced program of acquisition of new equipment and modernization of existing equipment.

4.4.2. Air Refueling Defensive Capability. Air refueling aircraft should possess a defensive countermeasure capability commensurate with the threat level they expect to encounter. Outfitting air refueling airframes with defensive countermeasures permits air

refueling tankers to accomplish their tasks across a wider spectrum of operations. Given the probability of a vast range of regional contingencies and varied conflicts and the proliferation of anti-aircraft weapons, planners cannot guarantee where on the globe or under what level of threat air refuelers will operate. US air refueling forces are increasingly tasked to perform missions in hazardous situations, both in war and most recently during military operations other than war (MOOTW). Many of these missions require some level of defensive, self-protection equipment.

4.4.2.1. Historically, air refuelers have not been equipped with self-defense equipment. Instead, planners could only reduce the risk to the air refueling effort through threat-avoidance tactics, threat suppression by ground forces, and escort protection by fighter and ground support aircraft. In many cases it may not be politically viable to have fighter aircraft accompany the air refueling effort, especially during certain types of MOOTW. Clearly a wide range of situations exist, necessitating the inclusion of an air refueling self-defensive capability.

4.4.2.2. The goal of this equipment is to preserve the capabilities and responsiveness of US air refueling forces. These defensive capabilities increase the probability of an air refueling aircraft surviving in a hostile environment but by no means provide perfect protection. Therefore threat avoidance will always be the first choice of tactics. However, a lack of defensive countermeasures may restrict air refueling aircraft to strictly permissive environments. This restriction effectively prevents our air refueling forces from fulfilling their aerospace role as force enhancers, and reduces their flexibility to support national policy across the range of military operations. Operational plans which entail exposing the air refueling force to certain medium- and high-level threats will have to consider the availability of air refueling aircraft possessing a defensive capability.

4.5. Airspace Control and Management. The use of air refueling in any theater or region should be integrated into the military airspace control plan as well as any civilian or international airway control system. This is necessary to ensure safe air traffic conditions and minimize the probability of fratricide by US or coalition forces. Perhaps a greater threat than enemy fire is the threat of a mid-air collision with friendly air forces. Air refueling planners should coordinate with the airspace control authority (ACA) to ensure air refueling operations are deconflicted and comply with all routes and procedures through any area they may transit. The nature and intensity of the overall air operation may require the establishment of specific corridors en route to air refueling tracks and anchor air refueling areas within a theater. Air refueling tracks and anchor areas should be well defined. The routing of en route corridors should be coordinated between the ACA, the Director of Mobility Forces (DIRMOBFOR), the Tanker Operations Cell (TOC), the Airlift Coordination Cell (ALCC), and the Air Mobility Element (AME). These individuals and organizations should take into account all other theater operations and any likely airspace threats to air refueling forces. The enemy threat and the evolving nature of theater operations may cause frequent changes to these en

route corridors and air refueling tracks/anchor areas. The organizational structure of theater air refueling places the Tanker Operations Cell as a functional part of the theater Air Operations Center (AOC) and allows the close integration of daily air refueling operations in the area of responsibility (AOR). The AME provides the coordination for strategic air refueling of air assets entering the AOR and works closely with the ACA within the AOC. It is the responsibility of the AFCC and the ACA, with inputs from the Tanker Operations Cell and the AME, to ensure procedures for the airspace management of air refueling operations are sufficient to provide for the efficient and safe operation of all air refueling aircraft in theater.

Chapter 5

STRATEGIC AIR REFUELING

5.1. Operational Concepts. Strategic air refueling, sometimes referred to as intertheater air refueling or global air refueling, supports the long-range movement of airlift and combat air forces between theaters. This includes air refueling support for the United States Single Integrated Operational Plan (SIOP). Air refueling tanker forces allow for rapid deployment of fighters, bombers, and combat support aircraft. Strategic air refueling supports the "airbridge" that links overseas theaters to the continental United States (CONUS). It supports all Department of Defense agencies, as well as some non-DoD agencies such as the Departments of Energy, State, Justice, and Transportation. It is a vital part of the balanced mobility force structure, and is essential to the attainment of objectives set by the NCA.

5.1.1. Nearly all military turbojet airlift, combat, and combat support airframes are capable of being air refueled. In cases where the distances to the theater or objective area are great and transit airfields are not available, air refueling may be the only option available to move these forces into the theater. In situations where transit bases are available, air refueling planners have the option of employing air refueling operations out of the transit base to increase the payload of the air refuelers or to eliminate the air refueler's stop at the en route airfield. A consideration in planning to use air refueling is that it ties the air refueling operation to the availability of tankers. If a tanker air refueling is missed due to weather, equipment problems, or the tanker aborting its mission, the deployment mission flow could be interrupted. Another possible limitation to an air refueling plan may be a lack of refueling platforms to meet all refueling requirements. If tankers are tasked to deploy tactical aircraft to a theater, such as in the case of a fighter "drag," and provide continuing in-theater support in an employment role, the demand on such a limited number of air refueling assets may very well overtask the available tanker support capacity. This could restrict their availability for use in the air refueling operation.

5.1.2. Strategic air refueling forces are organized, trained, and equipped to perform the following tasks:
- Provide air refueling support for deploying airlift and combat air forces from CONUS bases to a theater or between theaters.
- Provide air refueling support for redeploying airlift and combat air forces between theaters or back to CONUS.
- Augment theater air refueling capability when practical.
- Perform assigned air refueling tasks involving nonlethal application of airpower.

5.2. Organization. United States Transportation Command (USTRANSCOM) has been designated as the DoD single manager for transportation (other than theater-assigned and

Service-unique assets). The primary Air Force component of USTRANSCOM is AMC, which is tasked with providing common-user strategic air refueling for the DoD and other government agencies. In addition, ACC is also identified as a component of USTRANSCOM for providing strategic air refueling missions, primarily fighter unit deployments.

5.2.1. United States Transportation Command. The mission of USCINCTRANS is to provide air, land, and sea transportation for the DoD across the full range of military operations. USTRANSCOM is organized into three Transportation Component Commands: Military Sealift Command (MSC), Military Traffic Management Command (MTMC),and AMC. USCINCTRANS exercises COCOM of AMC's strategic air refueling assets, as well as a limited number of ACC tankers for use in strategic air refueling missions.

5.2.2. Air Mobility Command. AMC is the operating agency for common-use strategic air mobility assets. AMC executes air refueling missions employing air assets assigned to USTRANSCOM supporting DoD-wide users. AMC organizes, trains, equips, and provides operationally ready air refueling forces, both active and reserve, for these worldwide strategic missions.

5.3. Command and Control. COCOM of all common user, CONUS-based strategic air refueling is exercised by USCINCTRANS. OPCON is exercised by the Commanders of AMC and ACC for their assigned forces. The Commander of AMC delegates OPCON to the TACC for mission management of these forces. The TACC manages, controls, and executes strategic air refueling missions through a global command and control system that includes fixed en route locations, as well as various deployable mission support forces (MSFs). Mobile command, control, and support elements are available to extend the air refueling system to forward locations or increase the capacity of established facilities in times of a crisis. The objective of these C2 elements is to assure a high level of responsiveness to national level taskings and provide effective use of air refueling forces. The TACC is the tasking, coordination, and execution agency for all USTRANSCOM air refueling activities. It provides the critical link between the common-user strategic air refueling customer and the unit assigned to provide that air refueling.

5.4. Planning Considerations. Large, concentrated strategic air refueling of airlift and combat air forces conducted at the air refueling forces' highest possible utilization rate is known as surge operations. The objective of the contingency or crisis reaction as determined by the NCA, and the guidelines set by the JFC, will be the governing factors for determining the priority, utilization rate, and structure of the air refueling support.

5.4.1. Individual, discrete air refueling support is normally associated with routine scheduled air refueling requirements. These air refuelings are usually planned well ahead

of time and should be coordinated by the TACC, consolidating as many air refueling requirements as possible.

5.4.2. Large or long-term air refueling requirements are usually associated and linked to a theater contingency operation such as Operation DESERT SHIELD. The availability of transit airfields for basing tankers with suitable facilities is critical to developing a continuous global air refueling operation. These transit bases allow air refueling planners a great deal of flexibility in basing tanker aircraft, providing crew rest facilities, supporting tanker maintenance, and establishing tanker refueling options for support of strategic operations. A key factor and possible limitation that needs to be addressed during any large sustained air refueling operation is aircrew availability. Massive numbers of air refueling missions, such as during the Gulf War, can quickly overburden the crews available to fulfill the requirements. The air refueling operation supporting the deployment into the Southwest Asia AOR during Desert Shield subjected strategic air refueling aircrews to continuous flight operations with minimum crew rest for extended periods of time. The overall air refueling plan should recognize and minimize the effect of aircrew availability on the operation's efficiency and level of safety. Another major planning consideration of the air refueling operation is its own level of support requirements or the footprint it imposes on the theater. The goal of an air refueling operation is to provide continuous air refueling support for aircraft entering and exiting a theater of operation; however, the air refueling system itself requires a certain level of resupply, maintenance, and command and control support from the theater to continue operations. Every attempt should be made to minimize the need for the theater to provide this support for strategic air refueling operations. Normally, this support to the air refueling operation should only be provided in theater by exception.

Chapter 6

THEATER AIR REFUELING

6.1. Operational Concepts. Theater air refueling forces provide common-user air refueling of combat and combat support air forces within a CINC's area of responsibility (AOR) and occasionally outside the AOR. The theater air refueling mission generally requires aircraft capable of operating under a wide range of tactical conditions including austere airfield operations. Theater air refueling assets are normally either assigned or attached by transferring operational control of tankers to a specific theater CINC as required by the situation. The theater air refueling system consists of air refueling aircraft, ground assets, and personnel assigned to the CINC's AOR. It also includes AMC and ACC shared assets deployed to provide air refueling support in the theater. On occasion, strategic air refueling assets may also be tasked to temporarily augment the theater air refueling system. Theater air refueling provides a CINC the flexible capability to place combat and combat support air forces virtually anywhere within the AOR without the need for forward staging bases. Fully integrating the use of theater air refueling into the CINC's overall theater air campaign plan maximizes the benefits of an effective theater air refueling system. During the Gulf War, the aggressive use of theater-assigned KC-135s was instrumental in employing theater combat and combat support air assets, including joint and multinational assets.

6.1.1. Theater air refueling forces are organized, trained, and equipped to perform the following tasks:
- Provide air refueling support to combat and combat support air forces within the AOR to project airpower, provide flexibility, and improve maneuver options for theater commanders.
- Provide air refueling support for joint and multinational operations when required.
- Augment strategic air refueling forces when required.
- Provide air refueling support to airlift and combat support air forces conducting non-lethal airpower tasks such as foreign humanitarian assistance, reconnaissance, and Airborne Warning and Control System (AWACS) missions.

6.2. Organization. Any organization of theater air refueling assets should be responsive to the needs of the theater CINC or the JFC to which they are assigned. The Air Force is tasked by the DoD to provide all common-user theater air refueling assets for the various theater CINCs or JFCs. The air refueling assets and personnel earmarked for supporting a theater are attached to the appropriate MAJCOM and fall under the OPCON of the Air Force Component Commander. At this level, prior to a contingency or crisis response, they are maintained and trained on a continuing basis to provide mission-ready air refueling forces to a theater commander. As the situation requires, theater air refueling assets are assigned or attached to a CINC by the Secretary of Defense through the CJCS. These theater air refueling forces will fall under the operational control (OPCON) of the

theater CINC. The majority of aircraft intended for use as theater air refueling support are in Air Mobility Command; however, two theaters (Pacific Command and European Command) have permanently assigned theater air refueling forces. In the event of a major regional conflict, AMC air refueling aircraft would either form or augment the theater air refueling forces in the AOR. Additionally, ACC provides limited air refueling support assets to the theater air refueling system.

6.3. Command and Control. The lowest practical level for organizing and operating common-user air refueling is normally at the theater level. It is possible during contingencies to attach theater air refueling forces within a sub-unified command level or a joint task force (JTF), depending upon the situation; however, in most cases this dilutes the efficiency of the theater air refueling system, since it decentralizes the control of these common-user assets. OPCON of theater air refueling forces should be delegated to the Air Force Component Commander (AFCC) since this ensures the availability of theater air refueling expertise to manage and coordinate this limited asset with other theater air operations. Normally a Joint Force Air Component Commander (JFACC) will be designated by the Joint Force Commander (JFC). The JFACC's responsibilities include, but are not limited to, planning, coordinating, allocating, and tasking based on the JFC's air refueling apportionment decision. The relationship of air refueling assets to the JFACC is the same as with any of the AFCC's other air operating forces. If the AFCC is designated the JFACC of a theater, OPCON of the air operating forces, including theater air refueling, is exercised by the JFACC. When a JFACC other than the AFCC is designated, the JFC should designate the level of authority to be exercised by the JFACC, usually tactical control (TACON) as a minimum. In all cases, the JFACC should exercise control of the theater air refueling assets through the AFCC. In addition the AFCC will be responsible for appointing personnel with air refueling expertise to operate the Tanker Operations Cell (TOC) within a JFACC's Air Operations Center (AOC).

6.3.1. The Air Operations Center. The AOC is the organization that is responsible for controlling theater air operations, including all theater air refueling operations. The AFCC normally exercises OPCON of assigned assets through the AOC Director. Within the AOC, (or the Joint Air Operations Center (JAOC) if a JFACC is established) the Tanker Operations Cell (TOC) manages and executes theater air refueling operations.

6.3.2. The Tanker Operations Cell. The Tanker Operations Cell (TOC) is the organization which functions within the AOC to plan, coordinate, manage, and execute theater air refueling operations in the AOR. The TOC chief heads this organization and reports directly to the AOC Director. The TOC integrates all theater air refueling activity with other theater air operations and coordinates with the Air Mobility Element (AME) regarding the strategic air mobility effort supporting the theater. Therefore, the TOC should coordinate with the AME (or with the TACC if no AME is established in theater) and the Director of Mobility Forces (DIRMOBFOR) if designated. The exact organization of the TOC will depend on the requirements of the theater and the AFCC's

concept of organizing and operating the AOC. Normally, the TOC will consist of an air refueling plans branch, an air refueling operations branch, and an air refueling logistics branch. These elements, though consolidated in the TOC, coordinate with various AOC planning and operational elements. Due to the nature of theater air refueling operations, it is critical that the TOC coordinate directly with organizations involved with combat and combat support in the theater.

6.3.4. The Air Mobility Element. The Air Mobility Element (AME) deploys to the theater as an extension of the AMC TACC, when requested. It coordinates with the theater air refueling management system and collocates with the AOC (or Joint AOC) whenever possible. The AME provides coordination and interface of the strategic air mobility system (airlift and air refueling) with the theater. The AME assists and advises the DIRMOBFOR, when established, on matters concerning strategic air mobility assets. AMC retains OPCON of the AME and will organize and manage the AME to support USTRANSCOM global requirements. The corporate efforts of the AME, TOC, and the Airlift Coordination Cell (ALCC) ensure the seamless execution of all air mobility operations in support of the theater.

6.3.5. Director of Mobility Forces. A DIRMOBFOR may be established to assist in the coordination of mobility issues in the theater. The DIRMOBFOR will normally be a senior officer who is familiar with the AOR and possesses an extensive background in mobility operations. The DIRMOBFOR may be sourced from the theater's organizations, or a nominee from USTRANSCOM or USACOM. When established, the DIRMOBFOR serves as the designated agent of the AFCC (or JFACC when established) for all strategic, theater, and organic airlift issues and strategic air refueling issues in the area of operations. The DIRMOBFOR exercises coordinating authority between the AOC (or JAOC when established), AME, and TACC in order to expedite the resolution of any strategic air refueling problems that surface from tankers supporting missions entering the theater of operation. The DIRMOBFOR's duties and authority will be as directed by the AFCC (or JFACC) to satisfy the objectives of the JFC.

6.3.6. Figure 2 illustrates a typical command and control structure for theater operations. Within this command and control structure, the Tanker Operations Cell (TOC) is organized within the Air Operations Center (AOC) with the Airlift Control Center (ALCC).

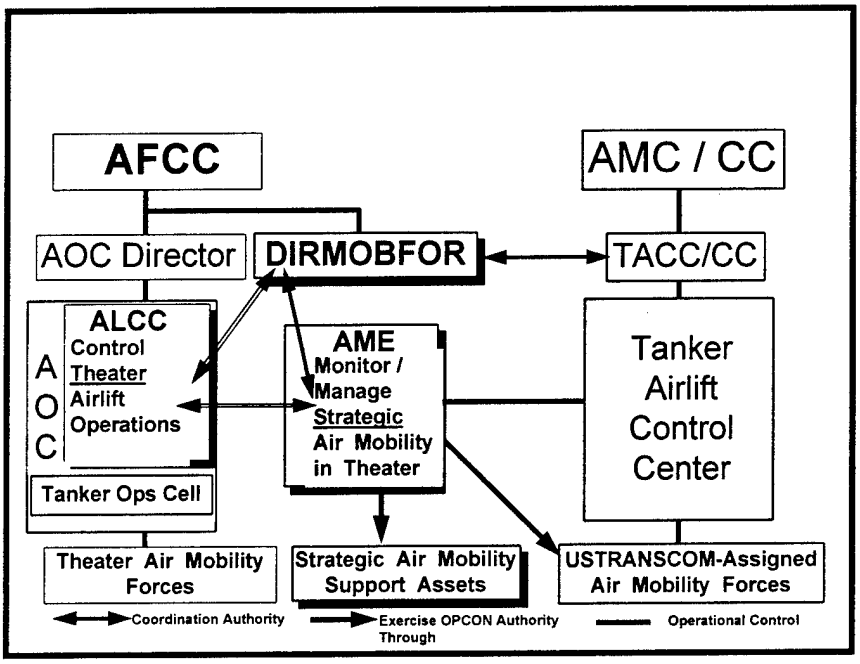

Figure 2. Theater Command and Control (Lambaria, 1996)

6.4. Planning Considerations. Once established in the AOR, the theater air refueling system becomes a functioning part of the air operating forces of the AFCC (or JFACC). The use of theater air refueling should be carefully planned and executed in accordance with the directives and policies of the AFCC and the theater CINC. As a general guideline, theater air refueling assets should not be allocated to a requirement that can be adequately fulfilled without the use of in-flight refueling. Air campaign operations should be planned to minimize the necessity for theater air refueling support unless that air refueling capability is providing a specific objective or end result to the operation not attainable without the support of air refueling.

6.4.1. The overall goal of theater air refueling planning is to support immediate and surge requirement operations while at the same time maximizing the contribution to the long-term accomplishment of the theater campaign. Air refueling requirements originate on either a predictable, recurrent basis or a surge operation basis. Recurrent operations establish evenly spaced requirements for air refueling missions. These operations allow planners to extract the maximum utility from available air refueling assets. Recurrent missions usually involve aircraft flying predictable schedules and air refueling tracks/anchor areas which could make them vulnerable to enemy detection and attack. This requires a low-threat environment or self-protection capability if the air refueling aircraft are to operate without tactical support.

6.4.2. Surge air refueling operations involve the sustainment of air refueling support within a limited time frame. This type of operation is often associated with the CINC's

scheme of maneuver for the campaign plan. The ability of theater air refueling forces to perform surge operations is of immense value to the campaign plan; it allows a CINC the flexibility to respond quickly and aggressively to opportunities in a rapidly developing battle scenario. The type of objective normally associated with surge operations usually exposes air refueling forces to a higher level of threat. As a result, surge operations will often require some level of tactical support, escort, or tanker defensive capability. Planners should consider providing additional security forces, especially for air refueling operations at forward locations. The disadvantages of surge operations are that they disrupt the efficiency of the overall theater air refueling system.

6.4.3. Immediate requests are short-notice priority taskings to provide air refueling. Maintaining some air refueling capacity in reserve to respond to priority immediate taskings guarantees availability of air refueling for these critical missions. However, this practice could reduce the efficiency of the air refueling system by denying the use of airframes to the daily air refueling requirements of the theater. Properly organized, trained, and equipped air refueling forces can usually respond rapidly to short-notice missions and locations in order to respond to immediate taskings. Therefore, operating the entire theater air refueling force at its maximum sustainable capacity each day should not undermine the timely reaction to shifting priorities of a theater campaign or short-notice emergency. The decisions to maintain a reserve (or alert) capacity should only be made after weighing the situational benefits that could be gained against the guaranteed loss of daily air refueling capacity to the theater.

Chapter 7

JOINT AIR REFUELING OPERATIONS

> *The nature of modern warfare demands that we fight as a team. The resulting team provides joint force commanders the ability to apply overwhelming force from different dimensions and directions to shock, disrupt, and defeat opponents. Joint warfare is essential to victory.*
> Joint Pub 1, *Joint Warfare of the Armed Forces of the United States*

7.1. General. Joint operations reflects the nature of modern warfare and the strategic requirements of the United States. Joint operations recognizes the fundamental and beneficial effects of teamwork and unity of effort, and the synchronization of Army, Navy, Marine Corps, and Air Force operations (or any combination of these Services) in time, space, and purpose (JP 3-0, 1995:II-1).

7.2. Joint Warfare. The integration of all US military capabilities is required to generate decisive joint combat power. Joint forces are organized with Army, Navy, Marine Corps, and Air Force components. Joint forces participate in force projection operations in both war and operations other than war. These operations may be either unopposed or opposed by an adversary. Joint exercises are key components of joint training and doctrine refinement (JP 3-0, 1995:II-4, IV-4).

7.3. Joint Air Refueling Operations. Joint air refueling operations are primarily focused on theater and contingency taskings that support Army, Navy, Air Force, and Marine forces. *Joint Air Refueling Operational Concepts, Organization, Command and Control, and Planning Considerations*, parallel 6.1, 6.2, 6.3, and 6.4 outlined in Chapter 6, *Theater Air Refueling*; however, they should be applied within the frame work of joint operations. As an illustration of the value of joint air refueling operations, Air Force air refueling support of naval fighters allows the Department of Defense savings through reduced need for carrier-based Navy tankers while increasing the combat power of carrier task forces.

7.4. Procedures and Terminology. When integrating two or more organizational cultures it is natural for each to bring established procedures and terminology to the joint arena, creating potential confusion and inefficiency. Joint air refueling operations will benefit from a standardized set of air refueling procedures and terminology. With this aim in mind, the Air Force should consider the integration of Navy and Marine Corps procedures and terminology. Following a joint review of these procedures and terms, the Air Force should become the central agency for air refueling procedures and terminology. A joint Air Refueling Technical Order should be written to standardize air refueling procedures and terms.

7.5. Air Refueling Equipment. The evolution of air refueling has resulted in two distinct forms of fuel offload equipment—boom and hose/drogue. Future air refueling operations will benefit from standardized tanker fuel-offload equipment. Acquisition managers (primarily Air Force and Navy) should consider designing future tankers and receivers with standard offload equipment. Although boom-type air refueling is currently the Air Force standard, planners should consider changing the primary offload equipment to hose/drogue. When a tanker is equipped with a hose/drogue at the tail and each wing, there are at least two distinct advantages over boom-type refueling: (1) increases the number of sources to offload fuel to waiting receivers from one boom to at least two hoses and (2) allows multiple receivers to receive fuel at the same time which expedites the transfer of fuel to large fighter formations.

Chapter 8

MULTINATIONAL AIR REFUELING

Almost every time military forces have deployed from the United States it has been as a member of – most often to lead – coalition operations.

General Robert W. RisCassi, USA
"Principles for Coalition Warfare"
Joint Force Quarterly, Summer 1993

8.1. General. The integration of all US military capabilities–often in conjunction with forces from other nations, other US agencies, and United Nations forces and capabilities–is required to generate decisive multinational combat power. Multinational operations, both those that include combat and those that do not, are conducted within the structure of an alliance or coalition. An alliance is a result of formal agreements between two or more nations for broad, long-term objectives. The North Atlantic Treaty Organization is one example. These alliance operations are technically combined operations, though in common usage combined operations are often referred to as multinational operations. A coalition is an ad hoc arrangement between two or more nations for common action, for instance, the coalition that defeated Iraqi aggression against Kuwait in the Gulf War (JP 3-0, 1995:II-4, VI-1).

8.1.1 The Armed Forces of the United States should be prepared to operate within the frame work of an alliance or coalition under other-than-US leadership. Following, contributing, and supporting are important roles in multinational operations–often as important as leading. However, US forces will often be the predominant and most capable force within an alliance or coalition and can be expected to play a central leadership role (JP 3-0, 1995:VI-1).

8.1.2 Doctrines, operational competence as a result of training and experience, and types and quality of equipment can vary substantially among the military forces of member nations. Multinational exercises are key components of combined training and doctrine refinement (JP 3-0, 1995:VI-3).

8.1.3 Many nations have the capability to conduct air refueling operations. Although detailed procedures are dependent on aircraft type, mode of employment, and national requirements, there is sufficient commonality for standard procedures to be developed to enhance operational interoperability (ATP-56, 1990:1-1).

8.2. Multinational Air Refueling Operations. Multinational air refueling operations are primarily focused on theater and contingency taskings that support participating nations' strategic and military objectives. Strategic air refueling permits US forces to rapidly get to the fight anywhere around the world. Once in theater, US air refueling forces can join coalition forces to operate under a multinational commander. Tankers are vulnerable to

hostile action; therefore, it is important to place them in a protected air environment or defend them with fighters. *Multinational Air Refueling Operational Concepts, Organization, and Planning Considerations*, parallel 6.1, 6.2, and 6.4 outlined in Chapter 6, *Theater Air Refueling*; however, they should be applied within the frame work of multinational operations.

8.2.1 *Allied Tactical Publication 56: Air-to-Air Refueling* (ATP-56), published by the North Atlantic Treaty Organization (NATO) should be used as a source document to guide multinational air refueling operations. This unclassified publication may be carried aboard military aircraft. The aim of the publication is to provide a reference document covering national air refueling equipment, air refueling capable aircraft, and procedures for multinational air refueling operations (ATP-56, 1990:1-1).

8.2.1.1 The goal of ATP-56 is to provide guidance for NATO national commanders and staff in order to promote the effective employment of air refueling in NATO air operations; lead to a better understanding of national air refueling capabilities; promote mutual air refueling support amongst suitably equipped NATO forces; and promote the development of mutual air refueling tactics and procedures (ATP-56, 1990:1-1).

8.3 Command and Control (C2). Successful multinational operations can center on achieving unity of effort from the outset. Participating nations need to provide the multinational force commander sufficient authority over their national forces to achieve this unity (JP 3-0, 1995:VI-6).

8.3.1 Alliances typically have developed C2 structures, systems, and procedures. Alliance forces typically mirror their alliance composition, with the predominant nation providing the alliance force commander. Staffs are integrated and subordinate commands are often led by senior representatives from member nations. Doctrine, standardization agreements, and a certain political harmony characterize alliances (JP 3-0, 1995:VI-6).

8.3.2 Coalitions are typically formed on short notice and can include forces not accustomed to working together. Establishing command relationships and operating procedures within the multinational force is often challenging. Though many C2 structures can be employed, coalitions are most often characterized by one of three basic structures: parallel command, lead nation command, or combination command (JP 3-0, 1995:VI-6).

8.3.2.1 Parallel command exists when nations retain control of their deployed forces. Lead nation command exists when the nation providing the preponderance of forces and resources typically provides the commander of the coalition force. Lead nation and parallel command structures can exist simultaneously within a coalition, forming a combined command. This combination occurs when two or more nations serve as controlling elements for a mix of international forces, such as the command arrangement

employed by the Gulf War coalition. Western national forces were aligned under US leadership, while Arabic national forces were aligned under Saudi leadership (JP 3-0, 1995:VI-6, VI-7).

8.3.3 It is possible during contingencies to attach theater air refueling forces within a multinational command and control structure, depending upon the situation. OPCON of multinational theater air refueling forces should be delegated to the Multinational Air Force Component Commander (MAFCC) since this ensures the availability of theater air refueling expertise to manage and coordinate this limited asset with other theater air operations. A Multinational Force Air Component Commander (MFACC) should be designated by the Multinational Force Commander (MFC). The MFACC's responsibilities should include, but are not limited to, planning, coordinating, allocating, and tasking based on the MFC's air refueling apportionment decision. The relationship of air refueling assets to the MFACC is the same as with any of the MAFCC's other air operating forces. If the MAFCC is designated the MFACC of a theater, OPCON of the air operating forces, including theater air refueling, should be exercised by the MFACC. When a MFACC other than the MAFCC is designated, the MFC should designate the level of authority to be exercised by the MFACC, usually tactical control (TACON) as a minimum. In all cases, the MFACC should exercise control of the theater air refueling assets through the MAFCC. In addition, the MAFCC will be responsible for appointing personnel with air refueling expertise to operate the Multinational Tanker Operations Cell (MTOC) within a MFACC's Air Operations Center (AOC).

8.4. Procedures and Terminology. When integrating two or more organizational cultures it is natural for each to bring established procedures and terminology to the multinational arena, creating potential confusion and inefficiency. Multinational air refueling operations will benefit from a standardized set of air refueling procedures and terminology. With this aim in mind, the Air Force should consider standardizing multinational air refueling procedures and terminology. *Allied Tactical Publication 56: Air-to-Air Refueling* (ATP-56), published by the North Atlantic Treaty Organization (NATO) should be used as a source document for multinational air refueling terms and procedures.

8.5. Air Refueling Equipment. Air refueling tankers use two basic types of equipment to offload fuel to receivers: boom and hose/drogue. It is essential that aircraft requiring air refueling are fitted with probes/receptacles, and fuel systems compatible with the characteristics of the tanker aircraft employed (ATP-56, 1990:3-1).

GLOSSARY OF REFERENCES, ABBREVIATIONS, ACRONYMS, AND TERMS

Section A--References

AFM 1-1, *Basic Aerospace Doctrine of The United States Air Force*
AFDD 2, *Theater Air Warfare*
AFDD 3, *Military Operations Other Than War*
AFDD 23, *Nuclear Operations*
AFDD 30, *Airlift Operations*
AFDD 35, *Special Operations*
Joint Pub 3-0, *Doctrine For Joint Operations*
Joint Pub 3-07, *Military Operations Other than War*
Joint Pub 4-01, *Defense Transportation System*

Section B--Abbreviations and Acronyms

Abbreviation or Acronym	*Definition*
ACA	Airspace Control Authority
ACC	Air Combat Command
AFCC	Air Force Component Commander
ALCC	Airlift Coordination Cell
AMC	Air Mobility Command
AME	Air Mobility Element
AOC	Air Operations Center
AOR	Area of Responsibility
ARC	Air Reserve Component
C2	Command and Control
CHOP	Change of Operational Control
CINC	Commander of a Combatant Command; Commander-in-Chief
CJCS	Chairman of the Joint Chiefs of Staff
COCOM	Combatant Command (command authority)
CONUS	Continental United States
DIRMOBFOR	Director of Mobility Forces
DoD	Department of Defense
JAOC	Joint Air Operations Center
JFACC	Joint Force Air Component Commander
JFC	Joint Force Commander
MAJCOM	Major Command (USAF)
MOOTW	Military Operations Other Than War
MRC	Major Regional Contingency
NATO	North Atlantic Treaty Organization
NCA	National Command Authorities
OPCON	Operational Control

PACAF	Pacific Air Forces
SECDEF	Secretary of Defense
SOF	Special Operations Forces
TACC	Tanker/Airlift Control Center
TACON	Tactical Control
TOC	Tanker Operations Cell
TALCE	Tanker/Airlift Control Element
USAFE	United States Air Forces in Europe
USCINCTRANS	Commander-in-Chief, United States Transportation Command
USTRANSCOM	United States Transportation Command

Section C--Terms

Combatant Command (COCOM) — (Command Authority) Nontransferable command authority established by title 10, ("Armed Forces") United States Code, Section 164, exercised only by commanders of unified or specified combatant commands unless otherwise directed by the President or the Secretary of Defense. Combatant command (command authority) cannot be delegated and is the authority of a combatant commander to perform those functions of command over assigned forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction over all aspects of military operations, joint training, and logistics necessary to accomplish the missions assigned to the command. Combatant command (command authority) should be exercised through the commanders of subordinate organizations. Normally, this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Combatant command (command authority) provides full authority to organize and employ commands and forces as the combatant commander considers necessary to accomplish assigned missions. Operational control is inherent in combatant command (command authority) (JP 3-0, 1995:II-6).

Operational Control (OPCON) — Operational control is the transferable command authority that may be exercised by commanders at any echelon at or below the level of combatant command. Operational control is inherent in combatant command (command authority). Operational control may be delegated and is the authority to perform those functions of command over subordinate organizations involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control includes authoritative direction over all aspects of military operations and joint training necessary to accomplish missions assigned to the command. Operational control should be exercised through the commanders of subordinate organizations. Normally this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Operational control normally provides full authority to organize commands

and forces and to employ those forces as the commander in operational control considers necessary to accomplish assigned missions. Operational control does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training (JP 3-0, 1995:II-7).

Strategic Air Refueling — Strategic air refueling is the common-user air refueling that provides the airbridge air refueling support linking theaters to the continental United States and to other theaters as well as the air refueling within the CONUS. These assets are assigned to the Commander-in-Chief, U.S. Transportation Command. Sometimes referred to as intertheater air refueling or global air refueling.

Supported/Supporting Command — Support is a command authority. A support relationship is established by a superior commander between subordinate commanders when one organization should aid, protect, complement, or sustain another force. Support may be exercised by commanders at any echelon at or below the level of combatant command. This includes the NCA designating a support relationship between combatant commanders as well as within a combatant command. The designation of supporting relationships is important as it conveys priorities to commanders and staffs who are planning or executing joint operations. The establishing authority is responsible for ensuring that both the supported and supporting commander understand the degree of authority the supported commander is granted (JP 3-0, 1995:II-8).

Tactical Control (TACON) — Tactical control is the command authority over assigned or attached forces or commands, or military capability or forces made available for tasking, that is limited to the detailed and usually local direction and control of movements or maneuvers necessary to accomplish assigned missions or tasks. TACON provides sufficient authority for controlling and directing the application of force or tactical use of combat support assets. Tactical control is inherent in operational control. Tactical control may be delegated to and exercised at any level at or below the level of combatant command. TACON does not provide organizational authority or authoritative direction for administrative and logistic support (JP 3-0, 1995:II-8).

Theater Air Refueling — Theater air refueling is the common-user air refueling that primarily provides air refueling support within a CINC's area of responsibility. These assets are normally either assigned or attached to the specific theater CINC. Sometimes referred to as intratheater air refueling or combat air refueling.

Section D—Air Refueling Terms

AIR REFUELING RENDEZVOUS - The procedures employed to enable the receiver(s) to reach the precontact position behind the assigned tanker(s) by electronic, radio, and/or visual means. The basic types of rendezvous procedures are the point parallel and en route. All other rendezvous procedures are modifications of the basic types. The type of rendezvous utilized is dictated by mission requirements, available equipment, and weather conditions.

EN ROUTE RENDEZVOUS - Procedure used when joinup is to be accomplished en route to the refueling area. An en route rendezvous is accomplished by having the tanker(s) and receiver(s) fly individual flight plans to a common rendezvous point, accomplish a joinup, and continue en route as a formation to the air refueling control point.

POINT PARALLEL RENDEZVOUS - The procedure normally used when the tanker arrives in the refueling area ahead of the receiver (a tanker orbit is normally planned). Accomplished with the tanker maintaining an appropriate offset and altitude while flying towards the receiver, the receiver flying a straight track towards the tanker, and the tanker turning in front of the receiver at a computed turn range.

RENDEZVOUS POINT - A general term that applies to any planned geographical point where a joinup between two or more airplanes is accomplished.

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Vita

Major Philip A. Iannuzzi, Jr., was born on 6 July 1961 in Philadelphia, Pennsylvania. After graduating from Archbishop Ryan High School in 1979, he attended Pennsylvania State University and received a Bachelor of Science degree in Business. He received a Master of Science degree in Systems Management from the University of Southern California in 1989. He was commissioned on 19 May 1984 through the Air Force Reserve Officer Training Corps.

He completed undergraduate pilot training in 1985 and was assigned to Plattsburgh AFB, New York. While at Plattsburgh, he held positions as a KC-135 Standardization and Evaluation Copilot, Aircraft Commander, Instructor Aircraft Commander, Instructor Flight Examiner, and Chief, Standardization and Evaluation Operations Branch. In 1991 he was selected for duty as a Combat Crew Training School instructor pilot at Castle AFB, California. In 1993 he earned a position as an instructor pilot in the KC-135 Combat Flight Instructor Course (CFIC) where he taught aircraft commanders how to be instructor pilots in the KC-135. Following the closure of Castle AFB, Major Iannuzzi transferred to Altus AFB, Oklahoma, the new home for the KC-135 flying training schoolhouse. After serving as Chief of Training, he was selected as Wing Executive Officer for the Commander, 97th Air Mobility Wing, Altus AFB. In September 1995, he entered the Advanced Study of Air Mobility program at the Air Mobility Warfare Center, Fort Dix, New Jersey, sponsored by Air Mobility Command and the Air Force Institute of Technology. He has accumulated 3,000 flying hours and has flown airlift and air refueling missions supporting Operations DESERT SHIELD/STORM.

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13. ABSTRACT *(Maximum 200 words)*

The United States Air Force, the aerospace arm of the United States' armed forces, has developed basic aerospace doctrine to guide and direct operations in the aerospace medium. Although aerospace forces perform many crucial "force-enhancement" missions, one is uniquely important to the success of military air operations—air refueling. Air refueling has become indispensable in modern warfare. The Air Force has published doctrine supporting its objectives at the strategic, operational, and tactical levels. Several fundamental and enduring principles in Air Force doctrine provide guidance on Air Force organization and execution of the air war; however, not all Air Force flying operations are governed by doctrine publications. Strategic and tactical bombing, air-to-air combat, close air support, and airlift doctrine have been developed, published, and refined since their implementation, but air refueling doctrine has yet to be published. This research paper proposes air refueling operations doctrine for the United States Air Force. The proposal offers a framework of fundamental concepts and doctrinal principles that should be included in Air Force air refueling operations doctrine. Air refueling doctrine should be used to guide decisions regarding operational employment of tankers as well as decisions regarding tanker force sizing, future weapons acquisition, and technology integration.

14. SUBJECT TERMS

Aerospace Power, Air Refueling (A/R), Aerial Refueling, Doctrine, Air Mobility, KC-135, Tankers

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AFIT RESEARCH ASSESSMENT

The purpose of this questionnaire is to determine the potential for current and future applications of AFIT research. **Please return completed questionnaire** to: AFIT/LAC BLDG 641, 2950 P STREET, WRIGHT-PATTERSON AFB OH 45433-7765 or e-mail to dvaughan@afit.af.mil or nwiviott@afit.af.mil. Your response is **important.** Thank you.

1. Did this research contribute to a current research project? a. Yes b. No

2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?
a. Yes b. No

3. **Please estimate** what this research would have cost in terms of manpower and dollars if it had been accomplished under contract or if it had been done in-house.

Man Years_____ $_____

4. Whether or not you were able to establish an equivalent value for this research (in Question 3), what is your estimate of its significance?

a. Highly Significant b. Significant c. Slightly Significant d. Of No Significance

5. Comments (Please feel free to use a separate sheet for more detailed answers and include it with this form):

_____ _____
Name and Grade Organization

_____ _____
Position or Title Address